RAILROAD GAZETTE

FRIDAY, AUGUST 24, 1900.

CONTENTS

Contributions

Brake-Beam Pressure.

Chicago, Ill., Aug. 14, 1900.

TO THE EDITOR OF THE RAILROAD GAZETTE.

In your issue of July 27, 1900, under the caption "Brake-Beam Pressure," appears a series of brake-beam tests, conducted under supervision of the department of railroad engineering of the University of Illinois. I desire to call attention to Table 1 of this article. In this table, the column headed "Increase of pressure due to rise of shoes—Per cent." has been computed from the data given in the other columns, using the final pressure as 100 per cent., an untrue basis, since it is the increase of the initial pressure which is under consideration. It will be noted that tables 2 and 3 are computed on the true basis of the initial pressure as 100 per cent. Column, "Increase of pressure due to rise of shoes—Per cent." as published, and again as corrected, follows:

Table No. 1.—Increase of Pressure Due to Rise of Shoes.

No. of trial.	Incorrect. (Final press. 100%) Per cent.	Correct (Initial press. 100%) Per cent.
7	35.0	53.8
8	42.0	72.4
9	35.0	53.3
10	22.0	28.6
14	28.0	40.0
15	47.0	87.9
Mean	34.8	56.0

An inspection of Table No. 1, as corrected, and Table 3, both of which were tests made when brakes were set by hand, will now show the mean increased pressure as follows: Table 1, 56 per cent; Table 3, 67.7 per cent. These tests therefore harmonize and show more uniform results than appeared from the article as published.

G. P. RITTER.

Y. M. C. A. Night Schools.

3 West Twenty-Ninth Street,
New York, Aug. 18, 1900.

TO THE EDITOR OF THE RAILROAD GAZETTE.

You and the readers of your valuable periodical are interested in all that improves the character and intelligence of young men.

Aside from the libraries, reading rooms, etc., etc., in hundreds of organizations, the Young Men's Christian Associations maintain a movement for evening schools in which definite standard courses of study are provided and followed. Last year in 350 associations, 26,000 different young men received instruction through the winter season from 1,215 teachers. The Annual Report gives in detail the record of the year's work, including that of the 134 evening schools taking the recent International examinations, the list of 1,498 successful students, and the names of the 108 colleges and universities which are encouraging this work to the degree that they give official recognition to our International certificates. The Prospectus contains a brief outline of the movement, its objects, the list of examiners, the outlined courses of study in twenty-six fundamental subjects, also the regulations governing the examinations, and the complete sets of questions used last year.

The more we can unitedly lead young men to be interested in all good educational facilities, the more will the public schools and colleges profit and all valuable periodicals, like your own, prosper.

GEO. B. HODGE, Secretary.

The "St. Paul" and the Northwestern Elevated.

On Aug. 13, the Chicago, Milwaukee & St. Paul changed the train schedule of its Evanston Branch so that all but seven trains a day each way are turned at Wilson avenue (Sheridan Park Station) and run back and forth between that station and the end of the Branch. Sheridan Park Station is the terminus of the Northwestern Elevated and at that point the Elevated has on one side the St. Paul Branch and on the other an electric trolley line, both of which form feeders for the Elevated. The St. Paul trains during the morning and evening hours are run every 20 minutes, while the Elevated express trains are run on a 4-minute headway from 6 a. m. to 9:10 a. m., and from 4:35 p. m. to 7:00 p. m. Passengers on the trains which are turned at Sheridan Park Station alight on a platform about 20 ft. from the Elevated stairs and pay a 5-cent fare into the city, the same as other passengers.

The St. Paul Company has no agreement with the Elevated Company and does not sell tickets for the Elevated trains. The tickets sold for the St. Paul trains are the usual commutation tickets and the rate from Wilson avenue to Evanston is $1 for ten rides, or 10 cents a trip. This, with the 5 cents Elevated fare, makes the rate 15 cents from the center of the city to Evanston. The old 25-ride rate from the St. Paul station to Evanston is $3.55, which is 14.2 cents per trip.

The new schedule of the St. Paul provides for 50 trains each way, of which only seven run down to the Chicago station. Under the old schedule there were but 27 trains each way, so that by the new arrangement the service is nearly doubled. The average time from Evanston to Wilson avenue by the trains making all the stops is 16 minutes, and by the express trains 12 minutes. The Elevated trains leave 2 minutes after the arrival and require 18 minutes to reach the first station on the Union Loop. The time in transit is about 10 minutes more than to go all the way by the steam roads, but on the other hand the Union Loop stations are in the heart of the business center whereas both the St. Paul and Chicago & Northwestern stations are at some distance and not nearly so accessible. For many the extra time in transit will be more than offset by the time to walk from trains to places of business; this and the greater convenience will doubtless result in an important traffic going by the new route. The new arrangement would appear to be preliminary to the more important scheme for bringing the St. Paul suburban trains down town over the Northwestern Elevated which is held up indefinitely by the refusal of the City Council to permit the Evanston Branch to be operated by electricity.

Rail Steel.

At the recent congress in Paris, on international tests of materials Mr. W. R. Webster spoke briefly on the matter of the composition of rail steel and his remarks are printed below. The English report to which he refers is that of which we made a short review Aug. 3, p. 526.

I would like to call attention to the report of the English committee appointed by the Board of Trade to inquire into The Loss of Strength in Steel Rails Through Use, as their work has been in the same lines as that of the American committee referred to by Mr. Colby. The following is quoted from Appendix VII of the English report: It is probable that the Board of Trade will expect or desire the committee to recommend an analysis for the guidance of engineers and manufacturers, which shall, in the judgment and experience of the committee, be the composition of the steel to insure a good and safe wearing rail. I therefore suggest, after careful consideration from the points of view of the manufacturer and user, that, exclusive of the iron, a steel rail should have the following range of composition:

	Minimum.	Maximum.
Carbon	.35 to	.5
Silicon	.05 to	.1
Sulphur	.04 to	.08
Phosphorus		.08
Manganese	.75 to	1.00

Mr. Edward P. Martin, of Dowlais, considered the suggested figures with me and approves them.

(Signed) E. WINDSOR RICHARDS.

Thirty-five to fifty carbon was recommended by the American committee of the International Association for Testing Materials for rails of from 50 lbs. to 75 lbs. per yard. The full requirements are given below:

Carbon	.35 to	.50
Silicon	Not over	.20
Sulphur		
Phosphorus	Not over	.10
Manganese	.70 to	1.05

These recommendations are remarkably close, especially when one stops to consider that the work was done in different countries by these committees entirely independently of each other, and that in America only acid Bessemer steel is used for rails; while in England both the acid and basic Bessemer steel are used.

The results compared above indicate that the suggestions which I have made in my paper as to each country preparing standard or representative specifications for each class of material can be easily carried out. It is not too much to expect that at the General Congress of the International Association for Testing Materials to be held in 1901 each country will present representative specifications and that the international specifications will be agreed upon. I take this occasion to state that Sir William Roberts-Austen, President of the Iron and Steel Institute, and the Secretary, Mr. Brough, are very anxious that the Congress should be held in connection with the Iron & Steel Institute, 1901. I know of no institution better fitted to assist us in this work than the Iron and Steel Institute, and trust that our next Congress will be held with them.

The English committee have been working at a great disadvantage, as in all cases of the broken rails examined they knew nothing whatever of the previous heat treatment of these rails in rolling, and this has such a great influence on the final structure of the rail that had it been known it would have accounted for many of the abnormal results referred to in the report. It is to be hoped that the work of the committee of the Board of Trade will be continued and that rails will be rolled under known conditions, and that rails from the same heat of steel will be finished hot, medium and cold, in order to get at the true value of the mechanical work of rolling at different temperatures. This will give much valuable information in one of the most important lines of research that has been too much neglected up to the present time.

In this connection I would suggest that a record be kept of the amount of shrinkage of the rails from the finishing temperature in rolling to the normal temperature. This would give an accurate check on the finishing temperature of rolling and after sufficient data has been collected these results could be introduced to great advantage in our specifications by merely stating that the shrinkage shall not be more than —— per cent. Of course manufacturers would object at first, but they would soon see that the good and simple check on the finishing temperature is something that is most required in order to produce satisfactory rails, even from the very best of steel chemically. I have said so much on the importance of the finishing temperature in rolling in my various papers during the past seven years that I will not take up any more of your time at this meeting.

The Water Supply of the City of New York.

Extracts from the Report of the Committee on Water Supply.

In August, 1899, the Board of Public Improvements of the City of New York proposed to make a long term contract with the Ramapo Water Company to furnish the city with water, and this alarmed a great many citizens and led to much public discussion. . . . The Merchants' Association requested the Board of Public Improvements to suspend action upon the proposed contract with the Ramapo Water Company, pending the result of an investigation to be made by a committee appointed by the Association. The request was acceded to and this committee was accordingly appointed by your president to investigate whether the need of the city for an additional supply was urgent; what was the best available source for an additional supply; whether the city's financial condition permitted municipal construction; whether the Ramapo contract, or any contract with a private company, was advisable; and, finally, whether there were legal or constitutional difficulties in the way of the city's acquiring and owning an additional water supply adequate to its needs, and, if any such difficulties were found, how they should be removed. . . .

The work of the committee, which has extended over a period of more than seven months, has been divided among four sub-committees, viz., an Engineering Committee, which has considered the present supply and the available sources of future supply, with their cost; also the use of salt water for fire protection and sanitary purposes; a committee on Municipal Finance and Public Policy; a Committee on Fire Protection and Insurance; and a Committee on Legislation.

The reports published, notably from the Engineering and the Municipal Finance Committees, contain much valuable information which has never before been published. . . .

It has been an exceedingly laborious matter to ascertain fully the city's investment in its water supply; but the work done has laid a foundation for a more scientific and accurate system of bookkeeping. The official reports of the Department of Water Supply are very incomplete and lack data necessary to any real knowledge of the management and finance of that important department. The data collected and analyzed under the direction of this committee demonstrate that the water works of the former City of New York have been and are a source of profit and not a financial burden.

The committee reaches the following conclusions from the data analyzed:

1. The maximum cost of water per million gallons by the Croton system was $54.20 in 1849.

2. The average cost per million gallons from 1866 to 1898, both inclusive, was $35.06.

3. The approximate average cost per million gallons in the year 1898 was $29.07, and in the period of 1898 to 1910 (the latest date when the present system and the works now being constructed will be able to supply the city with sufficient water even if recourse be had to meters and other means of reducing waste), it will be under $25, and probably in the neighborhood of $20, owing to the great relative

decrease of outlay and increase of consumption during the next few years.

4. The annual cost of distributing water to consumers is not less than $10 per million gallons at present, and this expense should be added to the cost of delivering water at the city limits. The relative cost, therefore, to the city per million gallons by the proposed Ramapo contract, which fixes the price of water delivered at the northern limits of the city at $70, and by municipal ownership is approximately:

Contract cost	$80.00
Average city cost, 1866-1898	35.06
Average city cost, 1898-1910	25.00
City cost, 1898	29.07
Excess cost by contract	44.94
Excess cost by contract	55.00
Excess cost by contract	50.93

5. The city has received an average revenue of $52.87 per million gallons for all water supplied by the Croton system since 1865.

6. The Croton system had yielded up to the end of 1898 a net profit of $21,473,084. In the year 1898 it paid a net profit of $1,881,843. The ratio of profit is increasing rapidly, and the annual net profit will probably exceed $4,000,000 by 1910.

7. The relative profit by municipal ownership and loss by the proposed Ramapo contract is:

City System.

	1866-1898.	1898.
Average revenue per million gallons	$52.87	$50.29
Average cost per million gallons	35.06	29.07
Average profit	$17.81	$21.22

Contract System.

Average cost per million gallons	$80.00	$80.00
Average revenue per million gallons	52.87	50.29
Average loss	$27.13	$29.71

Comparison on Basis of 1898.

Profit by city system	$1,881,843
Loss by proposed Ramapo contract	2,635,127
Total loss	$4,516,971

Comparison for Period of Forty Years, 1906-1945.

Poughkeepsie System* and Ramapo Contract.

Net profit by city system	$48,338,259.55
Deficit under Ramapo contract	60,241,811.32
Cash loss	$108,580,070.87
Plus value of Poughkeepsie system, all bonds having been paid	$36,880,000.00
Cash and property loss to city	$145,460,070.87
Estimated cash and property loss on second system, constructed by 1920, capable of supplying 250,000,000 gallons daily additional	$50,000,000.00
Final loss by the acceptance of Ramapo contract	$195,460,070.87

For the purpose of comparison of the relative financial advantage of municipal ownership and the proposed Ramapo contract we have made calculations of the cost under both systems, as shown in the table above; we have taken as a basis for the municipal supply the Poughkeepsie system as recommended by the engineers, the ultimate cost of which is $36,880,000 for a supply of 250,000,000 gallons daily. We have assumed that a plant, capable of delivering 100,000,000 gallons daily, would be completed in 1906 at a total cost of $29,691,000; we have further assumed that in each of the years 1911, 1914 and 1917 a further supply of 50,000,000 gallons daily would be needed and have calculated the cost thereof, making the total cost in 1917 $36,880,000. We have allowed for interest at 3 per cent., for a sinking fund of 4 per cent., for depreciation and the cost of operation. We find that in 1937 the bonds issued for construction would have been paid.

In calculating the cost under the contract system with the Ramapo Company, we have assumed a payment by the City to that Company for the same amount of water as delivered under the municipal system. Both estimates are based upon an increase of population at a rate justified by the increase in the last few years and a consumption relative to such increase; we have also estimated that the total annual City receipts would be, as at present, $50.29 per million gallons....

Under the proposed contract the payment to the Ramapo Company of $70 per million gallons, less the revenue from consumers at $50.29 per million gallons, would result in a deficit to the city of over $60,000,000. If the city should fail to build and operate its own water supply and should make a contract with the Ramapo Company it would suffer a loss of $108,000,000 in the forty years of operation. But that amount of $108,000,000 does not represent the total loss to the city, for it would own no plant under the Ramapo system, while, under the municipal ownership plan, it would have paid for its plant by 1937 and own it free of indebtedness thereafter. The total cash and property loss, therefore, would be $145,000,000 on a system supplying only 250 million gallons daily.

Furthermore, by 1920, another system to meet the increasing needs of the city and to supply an additional 250 million gallons daily, must be constructed. During the twenty-five years of the operation of this new system a further loss of at least $50,000,000 to the city would result, compared with a contract with the Ramapo Company, for such additional supply at the proposed price. This makes the total loss to the city during forty years over $195,000. The supplying of water to its citizens becomes an increasingly profitable enterprise, while on the other hand contracting with the Ramapo Company would probably result in giving that company the monopoly of all future additional supplies for the city of New York. . . . The investigation by the Engineering Committee shows that in Brooklyn, Queens and Richmond the present consumption nearly equals the present supply, that in Manhattan and the Bronx the consumption in 1903 will nearly equal the supply at that time available under present methods. It is therefore necessary for the citizens of New York to take immediate steps to prevent such a scarcity of water as was experienced before the New Aqueduct was completed. The year fixed above, 1903, as the date when the consumption will equal the supply, may be postponed if some of the waste can be lessened. . . . We are thus brought to the conclusion that an additional supply for all the boroughs of the city is imperative, and that measures should be taken to furnish the additional supply at the earliest practicable moment. The Engineering Committee estimates that from six to seven and one-half years will be necessary from the inception of the work to the delivery of additional water. Your committee most strenuously urges that immediate steps be taken to furnish an adequate supply of water, to be available, at the latest, in 1910. . . .

All the additional water that the City of New York is likely to need for many years to come, until its population shall increase to 18,000,000, can be obtained from the Hudson River above Poughkeepsie. It is proposed to build pumping stations and filter beds on the eeast side of the river, an aqueduct from Poughkeepsie to the northern limits of this city, and a reservoir near the northern limits. The plant thus constructed would be capable of supplying 250,000,000 gallons daily, although it is not proposed to build a plant capable of delivering at first more than 100,000,000 gallons daily. The 250,000,000 gallons a day, combined with the present supply, will meet the needs of the city for fifteen or twenty years to come. Thereafter increased pumping facilities at the same point, with additional aqueducts, will furnish an additional supply in any amount up to 1,500 million gallons daily. . . . To furnish 250,000,000 gallons daily from Poughkeepsie, the cost of construction would be $36,880,000; the yearly cost after construction, including interest at three per cent., operation and maintenance, $2,585,000; cost per million gallons, $28.33. This estimate includes the delivery of the additional supply at a level of about 132 feet above tide-water, the level of the Jerome Park Reservoir. To furnish from the same source 500,000,000 gallons daily, the construction cost would be $72,374,000; the annual cost after construction, including interest, operation and maintenance, $5,546,000; cost per million gallons, $30.39.

The alternative proposition of taking the water from the Adirondacks would be as follows: Construction cost, 250,000,000 gallons, $71,727,000; yearly cost after construction, including interest, operation and maintenance, $2,727,000; cost per million gallons, $30. To furnish 500,000,000 gallons, the construction cost would be $140,155,000; the yearly cost after construction, $5,338,000; cost per million gallons, $29.25. It should be noted that the above figures and those that follow do not include a charge for the sinking fund.

The advantages of the Poughkeepsie plan over the Catskill and the Adirondack are: Less ultimate cost; by the Poughkeepsie plan it is possible to postpone a considerable part of the ultimate cost, by constructing part of the plant; . . . water from the Hudson above Poughkeepsie could be delivered in six years; from the Adirondacks in seven and one-half years; the Adirondacks and the Hudson would furnish about the same amount, 1,500,000,000 gallons per day; the Catskill watershed, now controlled by the Ramapo Water Company, 260,000,000 gallons per day; including Schoharie Creek, not more than 460,000,000. The lesser length of the Poughkeepsie aqueduct is an important element in the time of construction; but it is quite as important in maintenance and protection. . . .

As to the contract which the Ramapo Company proposes to make with the city, the substantial features of it are that the Ramapo Company agrees at its own expense to build and maintain a system of water works by which it shall be able to furnish the City of New York 200,000,000 gallons of water daily. This water is to be delivered to the city at its northern boundary at the point of intersection with the present Croton Aqueduct, at a "pressure due to an elevation of 300 feet above the mean tide level," and for this water the City of New York agrees to pay $70 per million gallons, and is to be put to no other or further expense in connection with the supply, excepting the additional expense for distribution.

The delivery of water is to begin in 1902, and is to continue for forty years. It is not within the range of engineering possibilities for the Ramapo Company to deliver water in 1902, a date which gave that company three and a half years in which to construct its dams, reservoirs and aqueducts. The report of the Engineering Committee fixes seven years as the shortest probable time within which a system can be constructed to supply water from the Catskill watershed, which the Ramapo Company proposes to use. . . .

The committee recommends that no contract should be entered into with the Ramapo Water Company; that the policy of supplying New York City with water by contract should be opposed by all lawful means; that immediate steps should be taken by the City of New York to acquire an additional supply of 250 million gallons of water daily from the Adirondack Mountain watershed by either of the systems proposed in this report.

The Report of the Engineering Sub-Committee.

We have given above a very brief summary of the report of the Committee on Water Supply. This embodies only the broad conclusions of the Engineering Sub-Committee.

The Engineering Sub-Committee was made up as follows: Thomas C. Clarke, Past President American Society of Civil Engineers, Chairman; Rudolph Hering, Vice-President American Society of Civil Engineers, Vice-Chairman; and Messrs. Edward P. North, D. Le Roy Dresser, H. S. Haines, D. McN. Stauffer, Henry G. Prout, E. E. Olcott and R. R. Bowker, members. To this sub-committee was later added Mr. Henry R. Towne: Past President of the American Society of Mechanical Engineers. To this sub-committee were submitted for investigation and report the following three broad problems:

1. The present water supply of Greater New York, including its history and the consumption of water.

2. The need of more water, and the extent of that need at present and in the future.

3. The sources from whence an additional supply of water can be derived.

After deciding upon the division of labor and the proper fields for immediate original investigation, the sub-committee recommended the employment of the following engineers: Messrs. J. J. R. Croes, Foster Crowell, James H. Fuertes, George W. Rafter, L. B. Ward and Wm. B. Fuller.

This sub-committee and the engineers employed investigated consumption, waste and additional sources of supply with a good deal of care. The possible sources on the eastern side of the lower Hudson River were examined, the Hudson River and its immediate valley above Poughkeepsie, the Esopus, Catskill and Wallkill creeks west of the Hudson, Long Island sources, Staten Island sources and finally the Adirondack region.

The study of waste and its prevention was a subject which exhausted much time and money with probably but little profitable result. Concerning waste, while the committee is satisfied that it is considerable, it does not see any present prospect that it will be immediately reduced, while an increased water supply will be necessary within ten years or less. The committee thinks that some reduction of waste could be made by extension of the use of meters. We should not, however, forget the fact that the expense of a meter service may frequently be greater than the cost of water wasted. Meters should therefore be used with discrimination, but it seems safe to give to the Municipal Government the right to put a meter in any house. Furthermore, the Engineering Committee assumes that there will be a legitimate and desirable increase of water use per head of population, so that while we should not neglect to prevent waste so far as possible we must look forward to a bountiful, legitimate supply for the future.

We have for the present a daily consumption of 242,000,000 gallons; in 1901, 257,000,000 gallons; in 1902, 272,000,000 gallons, and in 1903, 287,000,000. With average rainfalls, and with no reduction in the per capita rate, we may, therefore, expect to pass 1903 with sufficient water for the needs of the city, but the margin is close. After 1903 the daily consumption will have passed the daily supply, and the shortage will increase each year.

This sub-committee recognized that the cheapest supply is to be had from the Ten Mile and Housatonic Rivers, which could deliver 750,000,000 gallons a day, but the Legal Committee advised the Engineering Committee that it would be impracticable to take this water because of interstate complications. Mr. Freeman, however, was much more confident of the practicability of using these sources of supply and expressed the idea that co-operation by the legislatures of the states could be had which would permit New York city to avail itself of this cheap and abundant source.

If these Connecticut waters can not be used the committee concludes that the Adirondack region is the only practicable source of abundant and proper water. This can be got by storage in the Adirondacks and bringing water directly down, or by pumping the water from the Hudson River above Poughkeepsie and filtering it. A consideration of cost and of the time necessary to produce results points to the advisability of using the Poughkeepsie source. It will be seen, however, that the Committee on Water Supply, quoted in the earlier part of this article, recommends the Adirondack source in such language as to leave the reader to infer that it does not recommend the Poughkeepsie project.

*Taking water from the Hudson River above Poughkeepsie.

The Transportation Show at Paris.

The Eastern Company of France has grouped, in drawings and tables, information of its rolling stock in a very convenient way, the study of the development of its locomotives beginning with the year 1852 and coming down to include 1899. The series 800 has been brought out since 1889 and has not appeared at any former exhibition. This series is distinguished by the adoption of a bogie truck forward, but the much later series, 2400, is naturally more interesting.

Of this series engine No. 2411 is shown at Vincennes. It is one of 32 designed for fast traffic with long grades of 6-10 of 1 per cent. and a difference in altitude at the two ends of the run of about 1,000 ft. The engines are designed to haul trains of 250 metric tons at an average speed of 55 miles an hour. The compound system, with four cylinders, is adopted for engines from 2401 to 2432 inclusive. Long and careful experiments with a compound and a simple engine showed an economy of 8 or 9

per cent. in consumption of water and 5 to 12 per cent. in the consumption of fuel.

These engines have been designed to develop 20 to 25 per cent. more tractive power than the class which they succeed without materially increasing the weight, which stands at 17 tons per axle and 24 tons on the bogie. The adhesion weight is 34 metric tons on four drivers. A carrying axle behind the drivers was rejected as adding unnecessary dead weight and greater additional resistances without giving compensating advantages. In these compound engines, as in those of the Southern of France, the high pressure cylinders are outside the frames and the low pressure cylinders inside; naturally, they are coupled to different axles. The Walschaert valve gear is used. The company has not yet finished the series of experiments laid out for these engines, but so far as they have gone they are very satisfactory. Very careful observations are being regularly made on trains running between Paris and Chaumont, 261 kilometers.

Alabama as a Field for the Railroad Builder.

Alabama with her new railroad building is furnishing evidence of business prosperity in the South. Latest reports indicate that thirteen companies are building extensions and new lines aggregating 250 miles. There are about thirty more projects in varying stages of preliminary activity. Last year the new road built in the state aggregated 160 miles, the year before 150 miles, and 135 miles in 1897. For the five years before the total was but 197 miles, or an average of less than 40 miles a year. The average for the five years ending 1891 was 268 miles which was nearly seven times as large. Alabama's record year in railroad building was 1888, when she added 383 miles to her mileage. In 1887 the new mileage was 341, and in 1890 it was 281 miles. With the road recently added the state now has about 4,065 miles in operation.

The Louisville & Nashville, which operates a large mileage within the State, has a number of extensions under way or projected. Last year the Alabama & Florida was acquired in the interest of the company and completed from the main line at Georgiana, southeast 32 miles to Andalusia. Recently a contract was let for a further extension of 45 miles southeast to Geneva, to be completed by Oct. 1. It is understood that the line is to be still further extended to connect with the Pensacola & Atlantic Division in Florida. Last year the Louisville & Nashville built a line from Repton north 44½ miles to Pineapple on the Southern Alabama Division. This completed the road from Flomaton, on the main line, north through Repton and Pineapple to Selma, 119 miles. It is proposed to extend this line north about 60 miles to Blocton, where connection would be made with another line of the Louisville & Nashville, and so give the company a second line between Flomaton and Birmingham.

A similar duplication is proposed north of Birmingham in the Northern Alabama line incorporated early this year. It would leave the main line at Cullman and run south about 74 miles to Bessemer, which is on the loop to Blocton, proposed terminus of the extension from Selma, previously referred to. One survey has been made and a new one is just ordered. From Pineapple, on the Southern Alabama Division, a branch is building northwest 16 miles to Camden. The company is also making extensive improvements on the line north from Pineapple to Selma. Contracts are let for a branch from Hanceville, Blount County, on the main line near Cullman, to run six miles to mineral lands in Strout's Mountain. A number of other spurs and branches are building, including eight miles of track in Jefferson County to reach coal mines.

Surveys are also reported in progress for an extension of the Birmingham Mineral line from Champion near Oneonta, northeast about 30 miles to Guntersville, where connection would be made with the affiliated line, the Nashville, Chattanooga & St. Louis. This would give Guntersville and the country above a direct line into Birmingham. The Nashville, Chattanooga & St. Louis, in 1898, acquired the Middle Tennessee and Alabama, which extends from Fayetteville, Tenn., southwest 37 miles to Lax, Ala. It is being extended from Lax southwest 13 miles to Decatur, junction of the Louisville & Nashville main line and the Memphis branch of the Southern.

The Ensley Southern has been incorporated by the Southern Railway to run from that company's Northern Alabama line at Parrish southeast 28 miles to Ensley. It will complete the direct line between Birmingham and Memphis. Several surveys have been made by the Southern for a line from Stevenson, Ala., northeast to Chattanooga, Tenn. This would be about 40 miles long and would replace the trackage rented from the Nashville, Chattanooga & St. Louis at $5,000 per month. A number of short spurs to mines are also building or projected.

Under the charter of the Chattahoochee & Gulf the Central of Georgia is building from Columbia, in the southeast corner of the state, to run west about 88 miles via Dothan on the Alabama Midland line of the Plant System, Geneva and Elkton to Flomaton, which is on the main line of the Louisville & Nashville to New Orleans. The road is completed to Dothan, 21 miles, and work is in progress beyond. Last year the Searight branch was extended southwest 16½ miles to Andalusia. The two extensions will probably be brought together either at Andalusia or at a point south of that city.

The Mobile & Ohio has let a contract for 1½ miles of extension at Blocton for coal traffic. A branch is proposed from Billingsley southwest about 15 miles to Selma. The company is also supposed to be interested in the Tombigbee & Northwestern, which is the successor to the Seaboard of Alabama. This road is being extended 15 miles to Healing Springs. Thence it is proposed to build it to a connection with the Mobile & Ohio in Mississippi.

New control has recently been obtained of the East & West Railroad of Alabama. It is 117 miles long and extends from Pell City, Ala., east to Cartersville, Ga. The proposition is to extend the road west about 30 miles to Birmingham and also east from Cartersville to connect with the Seaboard Air Line, giving that company entry into Birmingham. The Chattanooga Southern, so it is understood, is planning to build an extension from Gadsden, south about 125 miles to Montgomery, with a branch of 45 miles to Birmingham.

Among the newer roads building is the Alabama & Tombigbee which is projected from Coffeeville on the Tombigbee River east 59 miles, via Fulton on the Southern, and Lower Peachtree to Camden. It is completed from Fulton to Nettleboro, eight miles. The Chattahoochee Valley, which was opened in 1897 from West Point, south 10 miles across and down the Chattahoochee River to Riverview, Ala., is to be extended south 25 miles along the Alabama side of the river to Columbus, Ga. About eight miles was completed at last report. Surveys have been made for another extension from West Point north 30 miles up the river. The Tennessee & Alabama Mineral is building into the state from Lawrenceburg, Tenn., on the Louisville & Nashville, to run south 30 miles to Tuscumbia on the Southern. Grading is about completed, and several miles of track is laid. The Yellow River Railroad, which extends from Crestview, Fla., on the Louisville & Nashville, north 27 miles to Florala on the Alabama state line, is about to let contracts for an Alabama extension under the charter of the Florida, Alabama & Northern. It is to run from Florala northeast about 65 miles via Elba to Troy, Ala., junction of the Alabama Midland and the Central of Georgia. The Carrollton Short Line has completed three miles of its road from Reform, on the Mobile & Ohio southwest 10 miles to Carrollton. Some eight miles is graded.

Among the new roads projected are the Mobile & West Alabama from Mobile north 350 miles via Tuscaloosa to Florence; the Helena, Tupelo & Decatur, from Arkansas City, Ark., northeast across Mississippi to Moulton, Ala., and thence to Decatur; the Gurley & Paint Rock Valley, from Gurley north up Paint Rock Valley to Winchester; the Dothan, Hartford & Florida, from Dothan on the Alabama Midland, northwest 25 miles to Hartford, and thence 81 miles more to St. Joe, Fla.; the Chicago, Ohio & Gulf, from Tuscahoma near Florence, south 417 miles via Faunsdale and Linden to Horn Island, near Scranton, Miss.; the Anniston & Coosa Coal Field, from Anniston west 25 miles to Ragland in the Coosa coal fields, and the Atlanta & Alabama from Atlanta, Ga., southwest 200 miles to Selma, Ala.

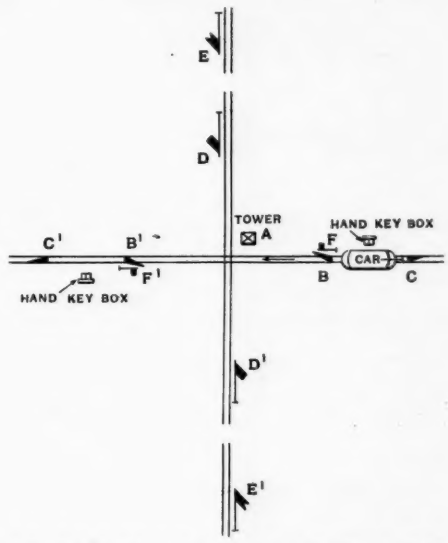
From the above resumé it will be seen that much the greater portion of the roads actually building are extensions of the larger companies. The center particularly attractive seems to be the coal and iron fields of the Birmingham region. There the development has been extremely rapid. In 1872 Alabama produced only 11,000 gross tons of pig iron. Last year she made 1,083,000 tons, which is a twelfth of all the iron product of the United States. Only three states, Pennsylvania, Illinois and Ohio, produced more. With iron ore beds of immense extent and suitable coal easy of access, Alabama's future is particularly bright. Development of this character calls for railroads. Hence the activity of the railroad builders of that state.

Electric Interlocking at Fremont and Genoa, Ohio.

[The article which appears below is reprinted from the *Railroad Gazette* last week. It appeared there with an engraving showing the interlocked dwarf semaphore signal as arranged for the street railroad, also the signal motor and the motors which work the interlocked derailing switches. Those engravings are not reproduced. By mistake the vital engraving was not shown last week, namely, the diagram showing the arrangement at the crossing. We reprint the article therefore with the diagram, but do not reproduce the other engravings.]

The Taylor Signal Co., of Buffalo and Chicago, has lately installed interlocking at two crossings of the Lake Shore & Michigan Southern where the main line of this road is crossed by an electric railroad. A diagram of one of these crossings is shown herewith, together with photographs of the motors which are used to work the derailing switches, a signal motor, and one of the signals used on the street line. These crossings are at Fremont, Ohio, and Genoa, Ohio.

The home signals on the Lake Shore road, D and D¹, stand normally at clear, and the distant signals, E and E¹, likewise. These home signals are each 600 ft. from the crossing and the distant signals are 1200 ft. from the home. The dwarf signals, F and F¹, on the street railroad, stand normally at "stop," and the derails which are situated near these signals stand normally open. The other derails, C and C¹, are normally closed. A train approaching on the Lake Shore road traverses a rail circuit from a point 500 ft. outside of the distant signal and 2,300 ft. from the crossing. After it passes this point its presence on the rails locks signals F and F¹. When this lock is released, that is to say, when no train is approaching, the signalman at *A*, after admitting an electric car to the point where the car is shown in the drawing, sets signals D and D¹ and E and E¹ against approaching Lake Shore trains. This in turn closes the crossing derail and opens the outlying derail on the electric line. The object of the outlying derail is to prevent conductors on the electric line neglecting to restore the signals on the Lake Shore to safety after they shall have passed over the crossing. It will be seen from the diagram that after the crossing is passed the crossing derail is first encountered, which is closed, but as the



Electric Interlocking for Steam and Street Railroad Crossing.

corresponding outlying derail is open before the car can proceed the main line signal must be cleared and this in turn closes the outlying derail.

When a signalman goes off duty he connects the controlling circuits to hand key boxes situated near the derails B and B¹, on each side of the crossing, and these derails and the signals are then operated by the conductors of electric cars.

The controlling circuit closers in the cabin have the Taylor interlocking apparatus, by which the display of conflicting signals is made impossible.

Return Circuits and Electrolysis.

From a paper read by Mr. E. E. Brownell, before the New England Waterworks Association, the following extracts are taken:

Let us briefly consider the usual construction of the return circuit, and see if there are any reasons for the escape of the current from the rails. Take, for example, the rail bonding commonly used for 90-lb. girder rails. Here they generally have but one No. 0000 copper bond. If properly bonded so that the relative conductivity of the bond was equal to that of the rail, it would require at least nine No. 0000 copper bonds, assuming perfect electrical contact between the bonds and rails. I have carefully tested the efficiency of the bonds used on some 37 different electric roads, as compared with the conductivity of the rails, and the highest found was but 15 per cent., while the remaining 36 varied from that down to zero. In four different cities, where what is called the "cast-weld" joint has very recently been installed, these joints showed seven, eight, nine and 11 per cent. efficiency of the relative conductivity of the rails.

A 36-in. water main offers 4.6 times the resistance of a perfectly bonded 90-lb. girder rail, or 18.4 times the resistance of a double track, perfectly bonded. From these figures we can definitely say that with perfect rail bonding, which is by no means a practical impossibility, a 36-in. water main buried under a double track of 90-lb. rails would never carry more than one-eighteenth of the current. But we find, in actual practice, that the rails have often but one-tenth of the current, on account of the high resistance of the bonds. In three sizes of water mains, 6, 20 and 36-in., an average of 37 per cent. of their total resistance was found to be in the joints of these pipes.

Early forms of iron bonds soon proved inadequate, and were succeeded by solid copper wires, either riveted or wedged by driving taper pins or cones. It was found that these wires were broken by the motion of the cars upon the rails. The copper was then laminated, and the bonds put under the joint plate, but lamination has, in many cases, merely hastened the breaking of the copper. Many of these bonds have failed entirely during a single year. Irrespective of the breaking of the bond, its conductivity may be greatly reduced by the rusting of the surface of contact between the steel and the copper. The New York, New Haven & Hartford, between Hartford and New Britain, Conn., has used up two different sets of copper bonds in two years' service. These were of high resistance, even when new, though their theoretical conductivity should have been equal to that of the rail. After the second set of copper bonds had failed, the Edison-Brown bond was applied, one under each angle-plate. Recent tests show that the conductivity of the joints through these bonds is practically the same as that of the rail.

Let us for a moment look at the conditions found in the city of Indianapolis, Ind. Here four 90-lb. rails, which were carrying less than 200 amperes each, as measured upon the terminals near the power house, showed the loss or fall of potential of 145 volts, in four miles of the double track. With perfect rail bonding, this loss could be reduced to less than 20 volts. In another portion of the city, where the rails should be returning 500 amperes, they were carrying

but 15 amperes. Thus, the remainder of the current was at work destroying the pipes. These are but a few examples of hundreds of such cases, which I have found in all parts of the country. In the city of Detroit, Mich., the rails with the inadequate bonding are supposed to take care of and return as a momentary maximum load 13,000 amperes; 2,000 amperes per rail should be the maximum, if each rail was a continuous piece of metal.

Some Notes on Rail Joint Fastenings.

BY F. C. SCHMITZ, ASSOC. M. AM. SOC. C. E.

(*Continued from page 504.*)

TRACK FEATURES AFFECTING THE EFFICIENCY OF ANGLE BARS.

Elsewhere have been discussed the constructive features of the angle bar splice, together with their bearing on each other. In the order named they were as follows:

1. Strength of angles.
2. Design and workmanship (fit of cross section, etc.).
3. Efficiency of the bolts.
4. Material.

As was then explained, the importance of each is represented by its position in the list. The above factors in the efficiency of angles are constructive features. In other words, they are inherent in the angle bar. To these must be added another set of factors that are independent of the angle to a great extent, and which may properly be called track characteristics or conditions, under which the angle must operate. The importance of each is again represented by its position in the list.

1. Spacing of joint ties and length of angle.
2. Ballast.
3. Support or suspension of joint.
4. Tendency of rails to creep.
5. Allowance for expansion and length of rail.
6. High or low joints.
7. Broken or even joints.

(1) Expert opinion in regard to the proper length of angle bar joints varies from 12 in. to 48 in. Ideas have changed with cyclic regularity, tending sometimes toward one extreme and sometimes toward the other. When the long joint, with three tie support, is popular, argument after argument is brought out to show its superiority, only to be entirely thrown over when the pendulum has swung the other way, and the short joint is once more in favor.

If we assume splices long enough to meet in the center of the rail, it is obvious that they would break the rail at the latter point. On the other hand, if we assume a joint of zero length, it would be broken by the rail ends. Where is the point, between these extremes, at which the joint does its work most perfectly?

Let us assume a rail of indefinite length supported by a system of ties in an elastic bed and carrying a series of loads 56 in. apart (a fair distance for engine drivers). See Fig. 8. Under such a system of loads, the crests in the rail will be 56 in. apart, as will be the hollows. In other words, the curve of the rail reverses every 28 in.

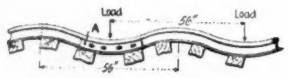


Fig. 8.

Fig. 9.

Fig. 10.

One tie support — Fig. 12.

Three tie support — Fig. 13.

Suspended — Fig. 14.

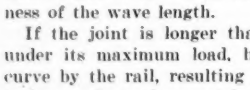


Fig. 14-a.

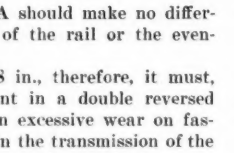


Fig. 15.

The fact that a joint exists at A should make no difference whatever as to the action of the rail or the evenness of the wave length.

If the joint is longer than 28 in., therefore, it must, under its maximum load, be bent in a double reversed curve by the rail, resulting in an excessive wear on fastenings and a serious restriction in the transmission of the wave motion in the rail. For any other position of the loads one reversion is inevitable in the curve of deflection. Under the latter condition, however, the shorter the joint the less the reversion and the more perfect the transmission of the wave motion.

The maximum length then for a splice is 28 in. and there is but one condition demanding that. If a shorter bar, therefore, does the work satisfactorily under that condition, it should be used. The difference in total deflection of a 24-in. and 28-in. joint for a given load is less than .01 in. under actual conditions, consequently the shorter joint may be used with perfect safety. Furthermore, the stresses in the bar for the shorter length are no greater.

Of course, the same argument applies for even shorter lengths. There is an objection to their use, however, that is vital, and that is the factor of proper tie bearing. A second criticism of the shorter length is that sufficient bolt spacing is difficult to obtain. All things considered, 24 in. is the best length for a joint intended simply as a splice and many of the better railroads are rapidly approaching that length as standard.

It is unformly conceded that the correct spacing of joint ties in suspended joint work is 10 in. clear for square ties. A canvass of 1,035 Section Foremen of one of the prominent railroad companies of the United States showed 82 per cent. in favor of 10 in. clear and 18 per cent. in favor of 8 in. The reason given, in almost every instance, for the long space was that it was necessary for proper tamping. Free rail ends will deflect four times as much, under a given load, as will the body of the rail for equal tie spacing. Therefore, any system that can be devised for reducing the joint tie space without restricting tamping, is worthy of trial, because the shorter the joint space the greater proportion of the load is carried by the rail ends, and the less stress is thrown into the joint fastening.

Fig. 9 shows that a 10-in. space is the shortest that can be used with square ties. Any shorter space interferes with the free swing of a tamping pick. To shorten this space some system must be employed that gives the effect of a 10-in. space, but that admits of having the ties a less distance from center to center.

Fig. 10 represents such a device. It has been tried by the Germans very extensively, and with good success. By using beveled ties a saving of 2 in. can be made which would allow of using a joint enough lighter to pay for the labor of beveling. It is to be regretted that experiments have not been made in this country along these lines. When so much labor and thought is being expended in other directions to reduce the maintenance expense of joints, some, at least, should be devoted to this phase of the situation.

(2) Ballast affects the life and efficiency of joints in two ways; first, its ability to distribute the tie loads; secondly, its resistance to crushing into powder after many tampings.

Under a given traffic, that material which spreads the tie load over the greatest area of subsoil makes the best ballast. The reason for this is obvious. The less deflection of ballast in subsoil, the less disintegration of ballast under loads, and, consequently, greater support to ties. It is the deflection of ties in ballast that injures joints and that must be restricted if the joint is to be aided.

An experiment made in Germany, unfortunately not under working conditions, showed that crushed stone distributed the pressure much better than any of the other types of ballast, and that, consequently, the deterioration was much less. Corroboration of the above results is offered by the writer. The readings of the deflectograph (to be described later) show conclusively that track, for a given traffic, deteriorates more slowly on stone than any other kind of ballast.

In regard to crushing due to tamping, the German experiment above quoted shows that, after a given number of tampings, the stone ballast had but 25 per cent. of the dust contained in the other kinds experimented with.

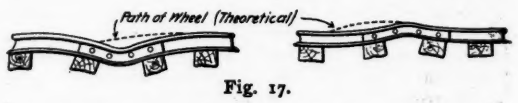


Fig. 17.

Unfortunately no experiments have been made under actual working conditions. That there should be some is obvious. They should extend, however, over a long period of time, under all the possible conditions of traffic, ballast, weight of rail, ties, etc.

The profiles (Fig. 11) show one of the results obtained in endeavoring to ascertain the effect of train loads on ballast and subsoil. They are interesting because they show that the tie does not by any means follow the rail in all its vertical motion. In other words, the rail lifts clear of the tie, and there must, as a consequence, be a decided augment to the load.

(3) There are three systems of joint supports in general use in the United States, namely: One tie support, Fig. 12. Three tie support, Fig. 13. Suspended, Fig. 14.

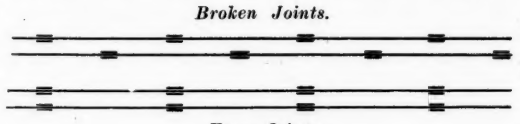


Fig. 18.

The question of the comparative merits of these three systems is a much-abused subject. Most railroad men have a hobby, and there seems to have been more who have taken this question for a fad than any other. As a matter of fact, the whole question is minor. 50 per cent. of the larger railroads use the suspended joint, 30 per cent. use a supported, and the other 20 per cent. are in process of evolution from one to the other. From a theoretical standpoint the suspended joint has a slight advantage, for two reasons. 1st. It requires no spike slot near the center of the bar where the stresses are maximum. 2d. The point of greatest impact (a) falls between two ties in the supported joint and directly on one in the suspended joint. The consequent deterioration of two ties, in the supported joint, leaves a longer unsupported space than is the case in the suspended joint where but one tie goes down. However, the first of these two conditions assumes that the joint should resist the creeping tendency of rails, an assumption that many persons are entirely unwilling to grant. The second assumes that there must of *necessity* be a greater shock at the joint than is endured by the body of the rail, due to an irreparable element of weakness in the former. This assumption is not correct unless it is deemed imperative to use the common angle bar fastening, without base support.

A condition that is much more common than is usually admitted, and which really ought to be considered a system of laying, is shown in the sketch, Fig. 14a. This is the worst possible condition in which a fastening can be placed. It is the result of carlessness, shearing of spikes from creeping, or many other kindred reasons, all of which are capable of being avoided. A still further aggravation of the trouble is where both ties are removed from the joint. Fortunately this is but rare in the United States. There are, however, several patented joints so constructed as to fit between joint ties, having no bearing on either. In England much of the rail is laid in this way.

Practically it is well nigh impossible to maintain any system strictly. Creeping of rails, shearing of spikes, stripping of slots, carelessness of foremen, etc., permit a motion of ties that alters materially the conditions holding when the steel was laid. Less than 50 per cent. of track has truly suspended or supported joints, and on many lines priding themselves on their equipment the section formen do not know what the standard joint tie

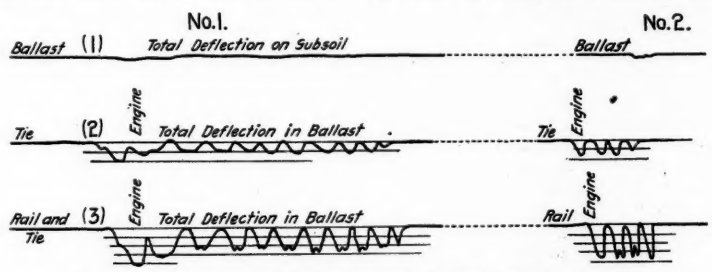


Fig. 11.—Synchronous Deflections of Ballast, Tie and Rail.

Vertical Scale: Full Size.

Rail, 85 lbs; Ballast, stone, much dirt, wet; Ties, oak, good; Tie space, 24 in. center to center; Roadbed, clay, very wet. Joint, angle bar.

Diagrams No. 1 (on left of engraving) freight-train, 30 miles an hour. No. 2 (on right of engraving) Fast-passenger train, 50 miles an hour.

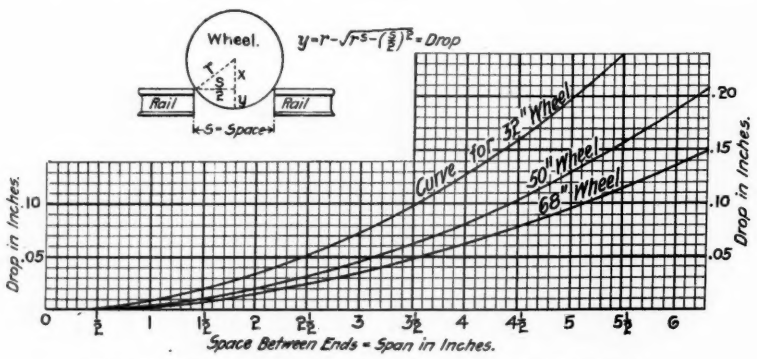


Fig. 16.—Drop of Wheels Due to Space Between Rail Ends.

space is, or whether there are any rules relative to the proper manner of laying a joint. With properly constructed joints the question becomes very unimportant, with a perfect joint, eliminating the joint from track the discussion drops from the rail joint situation.

(4) Railroad track tends to creep in the direction of traffic. On double-track lines with traffic always in the same direction on the same track, the tendency is great. On single-track lines having practically an even traffic in both directions, it hardly has an existence.

Creeping is due to the ironing out process of a system of wheel loads. It tends to pull the rails apart at the loose joints and bunch them together or out of line at the tight ones. It is the universal practice to attempt to overcome this tendency by carrying the thrust to the joint ties through the splicing device. With angle bars it is attempted by driving the spikes through slots cut for the purpose. That it is not successful is proved daily on every railroad in the United States.

All joints that carry the running tendency to the joint ties must fail in one of three ways.

1. Spikes shear off in the slots.
2. Slots strip out.
3. Joint ties work ahead in the ballast, as shown in the sketch, Fig. 15.

This latter condition is more common than is supposed, and occurs, in all kinds of ballast, on double-track work. When the ties have reached the condition shown in dotted lines, they cannot be properly tamped. Furthermore, all the time the ties are moving, the ballast is being rolled and pushed about under the ties, consequently maintenance of joints is very heavy. On one piece of track that has recently come under the writer's observation, where the rail was held by an anchor, the section foreman claimed that the joints could be kept in surface with but 30 per cent. of the labor expended on joints of the same kind at either end of the anchored section, showing that, could the joints be held, a considerable part of the maintenance expense could be avoided. The section referred to above, while costing less, was superior to the track on either end, except for the strength derived from numbers, carrying the same traffic.

Anti-creeping devices, placed in the center of the rail, and carrying the stress to the ties, as does an angle, are no more efficient than a joint, and for the same reasons. The rail joint is the weakest point in track, and it should not be expected to do other than splice the rail ends. A spike slot takes metal from the lower flange that is necessary to withstand the stress in the flange. A concrete anchor every 1,000 ft. with proper attachment to prevent creeping would solve the whole question. The cost of such a device, while heavy in the beginning, would be eliminated by superior track and less maintenance.

(5) The proper length of rail and allowance for expansion are so closely related that it is impossible to discuss one without the other. As track is at present put down, with 30-ft. rail and angle bar joints, it is practically divided into 120-ft. lengths in which there is no allowance for expansion. It is impossible to maintain all joints equally tight. The consequence is that, as the rail becomes cool, it pulls first at the loose joints, opening the rail space to the limit (nearly an inch). Usually there is enough space in one joint to allow for the expansion of 120 ft. of rail under ordinary changes of temperature. The result is that, in actual practice, at the present time, we have the effect of 120-ft. rails, with a poor joint at each end. Fig. 16 shows that for rail spaces of 1 in. the 32-in. car wheel drops .01 in. It is this .01 in., small as it seems, together with the poor joint that first starts the deterioration of rail ends.

There has been a wide tendency in recent years to allow more than is necessary for expansion. Some of the better thinkers, however, are now working toward a more rational view, and 60-ft. rails are at present being laid with but little more expansion than was formerly used with 30-ft. rails. Another feature in expansion is the large hole drilled in rails heretofore. It is not necessary, and should be abandoned. A maximum allowance of ¼ in. is ample for 30-ft. lengths.

(6) Tamping joints above the normal surface is a practice that, while it is quite common, is nevertheless to be heartily condemned. The reason of this is not, as has been stated by some theorists, that a wheel must of necessity climb a high joint, but jumps over a low one, as shown in Fig. 17. No joint is above the surface when a wheel is passing it, because of the large deflection of ties in ballast, and the real reason is that, tamping a joint high tends to lift the quarter points of the rail out of the ballast, resulting in uneven bearing, loosening of ties, etc. In cold weather the results are more dangerous than in hot, broken rails frequently being traceable to this cause. A joint, therefore, should never be tamped above the normal surface for any purpose whatever.

(7) There are but two methods of arranging joints in track in vogue in the United States. (See Fig. 18.) Sixty-five per cent. of the prominent roads lay their joints in broken order, 35 per cent. in even order.

It is claimed by some engineers that where joints are laid in broken order, the rail opposite the joint suffers, due to the additional shock of the wheel striking the low spot. If such is the case, it would certainly be much worse were there a weak spot in the track on both rails at the same point. The remedy is not to weaken the strong rail, but to strengthen the weak joint, thereby eliminating the oscillation and shock entirely.

There is more longitudinal oscillation where both wheels of an axle drop into a depression at the same time than where but one drops. The noise of broken joints is more incessant, but not so noticeable, as the heavy blows coming at longer intervals with the even joint.

The strong criticism against even joints, however, is the practical impossibility of laying them exactly opposite without frequently cutting rails. On curves it is necessary to cut every rail on the inside string to maintain the even system. If no other reason existed, the broken type should be used. Were the joints not in a chronic state of being below surface, and being the cause of shock and oscillation the whole question of arrangement would drop out of sight.

(To be continued.)

American Practice in Block Signaling.*

[With an Inset.]

BY B. B. ADAMS.

VII.

THE CONTROLLED MANUAL BLOCK SIGNAL SYSTEM.

When we leave the simple telegraphic block system, in which the essential feature is electrical communication between the two *men* situated respectively at the entering and the outgoing ends of a block section, and in which the outdoor signals are actuated solely by the hand power of these signalmen, we find practically all the rest of the block signaling comprised in two classes, (1) automatic and (2) "controlled manual." The automatic comes first, chronologically; and in this country it is now first in importance; but the more logical course will be to consider first the controlled manual. This class of apparatus, commonly called the "Sykes," after the name of the English inventor, W. R. Sykes, whose instruments were the first to be used in this country, is in use on the New York Central & Hudson River from New York to Buffalo, 440 miles; on the New York, New Haven & Hartford from New York (Woodlawn) to Boston, 220 miles, and on the Erie from Jersey City, N. J., to Turners, N. Y., 46 miles. In England the term "Lock-and-block" is commonly used to designate controlling apparatus of this kind.

The apparatus consists primarily of a series of electro-magnets so connected with the levers by which the operator moves the outdoor signals that the operator at the outgoing end of a block section controls the lever by which the operator at the incoming end admits the trains. Thus, after A sends a train to B and puts his signal at "stop," he is unable to again pull the signal to "all clear" until B unlocks his (A's) lever, and B, of course, refuses to do this until the train has arrived and passed out of the section. To provide against a possible mistake by B, who might prematurely unlock A's lever, there is also an automatic arrangement by which A's lever, after having been cleared to admit a train, and then put back again, cannot be unlocked until the train itself actually passes out of the section. This is secured by running an electric circuit, which controls A's lever, through two or three rail lengths of the track at a point just beyond B. The circuit goes from the battery to one rail of the insulated section of track, thence by line wire to A's signal, which it holds locked at "stop" by energizing an electro-magnet. On the passage of a pair of wheels over these insulated rails, most of the current passes through the wheels and axles from one rail to the other, and thence back to the battery, without going to the electro-magnet at the distant station. This demagnetizes that instrument and allows the signal to be again cleared.

It will be seen that where trains are run permissively —that is, where a second train passes A before the first one has passed B—the automatic feature of this system becomes useless, as the first train will release A's signal while the second train is still in the section, and the apparatus will then afford no protection against a careless operator admitting a third train to the section before the second has cleared it.

The controlled manual block signals on the Providence Division of the New York, New Haven & Hartford (Boston to Providence, 44 miles) are worked by the latest improved apparatus of the Union Switch & Signal Co., which was designed by Mr. John P. Coleman, Engineer of that company. The construction of Mr. Coleman's machines as there used is best understood by an examination of Figs. 1*a*, 3 and 4 of the drawings accompanying his patent on the apparatus; and the diagrams accompanying this description are copied from those which are used in the patent specifications.

To enable the reader to more clearly understand the apparatus, Mr. Coleman first describes (Fig. 1) a combined wire-circuit and track-circuit block signal system, and we shall therefore proceed to describe Figs. 1 and 1*a* together. The drawings are so arranged that the train movement to be considered is from right to left, and the stations, A, B, C and D, are thus arranged.

The reader who is disposed to omit this chapter because of the confusing mass of reference numbers on these drawings, especially in Fig. 1*a*, should bear in mind that the operations of the various electro-magnets and levers are in practice much simpler than they appear to be when considered through the medium of a written description. One unacquainted with electric signaling apparatus should prepare himself by reading through the description once, rapidly, in order to familiarize himself with the numbers of the principal parts, before attempting to read it with a view to minutely following out all of the different operations. By such preliminary reading a dozen or more of the principal numbers can be fixed in the memory, so that the references to Figs. 3 and 4, which are frequently necessary to make clear some part in Fig. 1*a*, need not interrupt the study of the circuits.

Fig. 3 is a side elevation of a Coleman signal, such as is used at stations C and D. Fig. 4 is a sectional elevation of the same. Fig. 5 is a front elevation, Fig. 6 a sectional plan, Fig. 7 explains the indicating mechanism and Fig. 8 is the banner. The appearance of one of these instruments when set up is shown in Figs. 9, 10 and 11.

Beginning now with Fig. 1, station A, lever 1 works signal 3 through the electric slot 2. (The electric slot is described in a subsequent article.) The locking mechanism consists of a pivoted sector block 4, provided with a projecting lug 5, which latter is raised whenever the signalman, preparing to move his signal, lifts the rod attached to his lever for the purpose of unlocking the lever. By the finger, 7, the armature of the electro-magnet, 9, controls the movement of 4, and through that controls lever 1.

The mechanism at station B is similar to that at A.

The circuit of electro-magnet 9 is formed by wire 13, make-and-break mechanism *a* on relay 14; wire 15, make-and-break mechanism *b* at station B, wire 16, battery, and wires 18, 19 and 20, wire 19 being common to all the stations. The spring and contact point *b* at B is controlled by sector block 4*b*, and is only closed so as to energize 9 (at A) when lever 1*b* is locked in the normal position (the position shown in the drawing). If this lever is not normal the circuit of 9 is broken at *b*, so that finger 7 will drop into the path of block 4, thereby locking lever 1 with its signal in the normal or stop position. Hence, it is necessary for the operator at A to ask B to put lever 1*b* in the normal position before he (A) can clear signal 3. Therefore, a train can never get permission to pass A until assurance has first been obtained that the block A-B is closed at its outgoing end. In other words, the apparatus compels such a procedure that a train cannot be given leave at one time to pass through two block sections.

A train being ready to proceed from A to B the signalman pulls lever 1, clearing signal 3, and the train proceeds. As soon as it enters on the section of track which is electrified by battery *y*, relay 14 is de-energized and the circuit of magnet 9 is broken at *a*. Finger 7 then drops and rests on 4, which has been shifted, by the signalman's action, to the position shown by the dotted line. Now, when the signalman, after the passage of the train, returns lever 1 to normal, finger 7 will drop farther and hold 4, so as to lock lever 1. Lever 1 cannot be again cleared (for a second train) until 7 is lifted by the armature of 9, which requires the circuit of 9 to be closed at *a*. This will be done when the last car of the train passes B, which allows battery *y* to again close 14.

But the train will not pass B until the signalman there clears his signal 3*b*, by pulling lever 1*b*. In doing this he opens (at *b*) the circuit of magnet 9, so that before A's signal can be again cleared, not only must the train have passed B; B must also have put his signal at normal, thus protecting the train by a stop signal behind it.

The "electric slot" 2 at A causes the signal to go to the stop position after the passage of each train, whether the signalman moves his lever or not. This prevents a lazy or careless signalman from permitting a second train to enter a block section before the first has passed out of it.

The circuit of the slot magnet is formed by wire 21, make-and-break mechanism *c* (formed by a second armature and contact point on relay 14) wire 22, electro-magnet 23, make-and-break mechanism *d* formed by armature and contact point of magnet 23, wires 24 and 25, battery 26, wire 27, common wire 19 and wire 21*c*. As soon as the train enters upon the track section between A and B, relay 14 is de-energized, and the circuit of the magnet of the electric slot is broken, not only at *c*, but also at *d*. The breaking of this circuit permits the signal to go to the stop position regardless of the position of lever 1. The second break (at *d*) is interposed in the electric slot circuit for the purpose of preventing the operator from throwing his lever forward to normal position, as soon as the train has passed beyond B (which passage restores the break in the slot circuit at *c*), and, without allowing his lever to lock, "pick up" the signal and shift it to all-clear without first getting the consent of B (by bell-code, telegraph or telephone) as required by the regulations.

The make-and-break mechanism at *d* is formed by the armature and contact point of magnet 23, so that the break at *d* cannot be closed except by the excitation of the magnet 23 through some other circuit than that formed through its own contact point and armature. This auxiliary circuit is formed by wire 21 extending from the slot 2, make-and-break mechanism *c*, wire 22, electro-magnet 23, wire 28, make-and-break mechanism *e*, wires 29 and 25, battery, wire 27, common wire 19 and 21*c*. The mechanism *e* is controlled by sector block 4, and is only closed to complete the auxiliary circuit, when lever 1 has been shifted to normal position and locked therein by the dropping of its latch.

The movement of the latch locking of the lever so shifts block 4 as to close the circuit at *e*, and this movement is such that the finger 7 will drop behind the sector block, thereby locking it until released by B, as described. The mechanical closing of the auxiliary circuit at *e* excites magnet 23, thereby closing the main electric slot circuit. This main circuit is necessary in order to hold the slot mechanism locked when lever 1 is shifted to clear

*Previous articles in this series may be found on pages 4, 34, 83, 121, 166 and 222.

the signal, as this movement of the lever will break the auxiliary circuit at *e*.

The line between stations C and D (Fig. 1*a*) does not have a track circuit, continuous from one station to the other, and the additional locking devices shown in the drawings at these stations are to provide other safeguards, taking the place of the track circuit. At B the passage of a train restores to A the control of lever 1 (if B puts his lever normal); but at C, instead of thus directly unlocking B, the passing train only releases C's plunger (30); so that the human agent must actuate in the plunger to make the passage of the train at C of benefit to the operator at B. The operator at C, instead of merely performing the routine function of putting his signal to danger, which he would naturally do, without regard to what was wanted at B, must also "plunge" (at the express request of B) and for no other purpose than to aid B in giving a clear signal to the next train. In practice C puts his lever normal as soon as a train passes; but he does not plunge for the next train until B requests him to do so.

Returning now to the train movement which we have followed from A to B, we shall note that the train cannot pass B until signal 3*b* is cleared. But this signal, having been placed normal to admit of unlocking A, cannot be again cleared without the consent of C. The apparatus by which C gives this consent is shown in Figs. 1*a*, 3, 4, 5 and 6.

On the bed of this mechanism is arranged a sliding bar or plunger 30, which is normally held in by spring 31. A locking dog, 32, is so pivoted that when free to move and the plunger is at the inward limit of its movement, a projection, 33, on the dog will drop into a hole in the plunger and hold it. When the mechanism is in normal condition, the dog is held up free from the plunger by arm 34. On the plunger is secured an angle piece, 37, one part of which projects upward so as to strike against and shift an arm 38, projecting from the rock shaft 35, when the plunger is pulled out, thereby so shifting the arm, 34, as to permit the dog to drop down. The movement of the plunger to shift the rock shaft and the arm 34 is sufficient to remove the opening in the plunger out of line with the projection on the dog, which will then rest upon the plunger until the latter returns to its normal or inner position, when the dog will be free to drop and lock it.

On the rock shaft carrying the dog is formed an arm, 32*a*, which, when the projection on the dog drops into the opening in the plunger, presses spring 39 against a spring, 40 (Fig. 6), which is attached to a block, 41, of insulating material, forming the make-and-break mechanism *f*. Fig. 1*a*. The continued movement of the arm 32*a*, will also force the spring, 40, out of contact with the spring 42, also attached to block 41, and forming, in connection with spring, 40, the make-and-break mechanism *g*. As indicated in Fig. 1*a*, spring 39 is connected by a wire, 43, to a binding post, 44, on the machine. The spring 40, is connected by a wire, 45, to one pole of an electro-magnet, 46, secured, as shown in Figs. 3 and 4, to the vertical frame 36, and the spring 42 is connected by a wire to one end of the resistance coil 47, also attached to the frame 36; the opposite end of the resistance coil being connected by a wire 48 to a binding post 49. The other pole of the magnet 46 is connected by a wire, 50, to a spring, 51, adapted to be forced into contact with a spring, 52, by an arm, 53, on the rock shaft, 35, as the shaft is rotated by the outward movement of the plunger, as described. These springs, 51 and 52, are attached to blocks of insulating material secured on the frame 36, and form the make-and-break mechanism *h*. The spring 52, is connected by a wire 54, to a binding post 55, on the machine.

On the swinging carrier 56, of the armature 57, of the magnet 46, is formed a slotted projection, 58, in which is pivoted a spring-actuated pawl, 59, adapted to engage a crossbar, 60, in the slotted end of the arm 61, carried by the rock shaft 35, when said arm is thrown up by the outward movement of the plunger as described. Pawl 59 remains in engagement with crossbar 60, only while magnet 46 is active. As soon as 46 is demagnetized, the weight of the several arms on the rock shaft, 35, will swing the carrier 56 out, thereby releasing the crossbar from engagement with the pawl. A second magnet, 62, has an armature, 63, secured to arm 64, of a bell crank lever. At the end of the other arm of the lever are formed shoulders or stops, 66 and 67. As arm 61 swings down, when magnet 46 is de-energized, crossbar 68 comes into contact with the shoulder 66, provided magnet 62 is not closed, as is the case when 46 is cut out to permit the arm 61 to drop. Arm 61 having been arrested by 66, it is necessary in order to permit it to complete its downward movement, that magnet 62 should be closed, lifting stop 66, whereupon 61 will drop a short distance, being again arrested by the upper crossbar, which is caught by stop 67. In order to release 69 from 67 and permit it to drop entirely down, magnet 62 must be cut out.

One pole of this magnet is connected by wire 70, to binding post 55, and the other pole is connected by wire 71 to a binding post, 72. A second connection is made from this pole of 62 to a spring, 73, with which spring 74 can be forced into contact by closing 62. These springs form the make-and-break mechanism *i*. Spring 74 is connected by a wire, 75, with a binding post, 76.

On a bracket, 77 (Fig. 3), is attached a miniature signal post, 78, and also an electro-magnet, 80, having an armature, 79, triangular in cross-section and attached to a shaft, 81. (See Fig. 7.) On the opposite or front end of the shaft 81 is attached a miniature semaphore blade, 82. The armature is normally held by a spring, 83, so that its apex is out of line with the pole of the magnet, the signal 82 being at the same time at normal or danger position. When the magnet is excited the armature will be shifted so that its apex is in line with the pole of the magnet, thereby shifting the miniature signal to safety position. This movement of the armature presses spring 83 against spring 84 at *j*. Spring 83 is connected by wire 85 to binding post 86, which is also connected to binding post 55, and spring 84 is connected by wire 87 to spring 88, normally in contact with spring 89, which is connected to the binding post 90. The spring 88 and the spring 89, with its binding post 90, are secured to the vertical frame 36 in such relation to the rock shaft 35 that a projection, 91, thereon (Fig. 4) will force one of said springs away from the other when the rock shaft is rotated by the outward movement of the plunger. Springs 88 and 89 (*k*) are separated at the same time, or nearly so, that 51 and 52 are forced together.

One pole of the magnet 80 is connected by a wire, 92, to binding post 93, and the opposite pole is connected by wire 94 to the binding post 95.

The rock shaft 35 has another arm, 96, carrying the lower end of banner 97. The upper end of the banner is guided by arm 98. When the banner is down the word "Free" will appear at the glass-covered opening in the case, indicating that the train has passed beyond the station, and that the signal has been shifted to and locked in normal position. When the banner has been raised by the outward movement of the plunger, the word "Locked" will appear at the slot in the case, indicating that the operator has unlocked the signal at the preceding station, and that his own unlocking mechanism and lever-locking mechanism are locked and cannot be shifted. When the banner has dropped to the intermediate position, as it will do when magnet 46 is cut out, the words "Train in block" will appear at the slot, thereby indicating that the train has passed the preceding station, and warning the operator to ask the next succeeding station to unlock his signal.

The circuit for the magnet 9*b* at station B is formed by the wire 99, make-and-break mechanism *l* (armature of track relay 14*b*) wire 100, binding post 44, wire 43, springs 39 and 40, (*f*) wire 45, magnet 46, wire 50, springs 51 and 52 (*h*), wire 54, binding post 55, wire 101, battery 102, wire 103, common wire 19, and wire 104 to opposite pole of magnet 9*b*.

A train having arrived at station B, the operator asks C to unlock his lever in order that signal 3*b* may be cleared. The operator at C thereupon pulls out the plunger 30, thereby, through the medium of the angle piece 37 (Fig. 4) and arm 38, so shifting the rock shaft 35 that the dog 32 drops and rests upon the plunger. The same movement raises arm 61, engages spring pawl 59, on the corner of armature 57, and so shifts arm 53 as to force the spring 51 into contact with 52. This, at *h*, completes the cautionary circuit, consisting of the battery 102, wires 103 and 104, springs 105 and 106, forming make-and-break mechanism *m*, wire 107, binding post 49, wire 48, resistance coil 47, springs 42 and 40 (*g*), wire 45, magnet 46, wire 50, springs 51 and 52 (*h*), wire 54, binding post 55 and wire 101 to opposite pole of battery. As stated, this circuit is closed so as to hold arm 61 up through the medium of magnet 46, provided *m* is closed. This make-and-break mechanism *m* is so connected to the locking finger 7*c* (signal lever 1*c*) as to be closed only when the finger has dropped into locking position in front of 4*c*; and, as before stated, the finger can assume this position only when signal 1*c* is locked in the normal position. If this cautionary circuit could not be closed by the movement of the plunger, so as to hold the arm 61 up, this arm would, when the plunger is released, drop back until arrested by the stop 66 on the arm 65, and thereby permit a hook, 108, to drop and engage a shoulder, 109, on the plunger. This hook, which is held out of the line of movement of the shoulder on the plunger by arm 38, when the arm 61 is held up, will, when released, as stated, prevent such a return movement of the plunger that the projection on the dog 32 can drop into the opening in the plunger. As such downward movement of the dog as is produced by the entrance of the projection 33 into the opening of the plunger is necessary in order to close the circuit through the lever-locking magnet 9*b*, it is evident that the cautionary circuit through *m* must be closed (and this is possible only when the lever 1*c* is locked at normal position) before C can unlock B.

If the lever 1*c* is locked in normal position, the cautionary circuit will be closed by the outward movement of the plunger, and magnet 46 will hold up arm 61. While 61 is held in this position, arm 38 will hold up hook 108 out of the path of the stop 109 on the plunger, so that the plunger can be returned to its normal position by its spring when released by the operator. The return of the plunger to normal position allows dog 32 to drop; arm 32*a* will then press spring 39 against 40, and also press spring 40 away from 42. Thus the dropping of dog 32 not only locks the plunger, but also completes the unlocking circuit through magnets 46 and 9*b* at *f*, and breaks the cautionary circuit through 46 at *g*. It will be observed that the breaking of the cautionary circuit is dependent upon the prior completion of the unlocking circuit, so that the arm 61 is not released from the pawl 59 by the break in the cautionary circuit, but will be retained in position by the closure of the unlocking circuit, until said circuit is broken as hereinafter stated.

The operator at C having by the outward pull and release of the plunger closed the unlocking circuit through magnet 9*b*, the locking finger 7*b* is raised, so that the operator at B can shift his lever and clear the signal 3*b*, permitting the train to pass on toward C.

The movement of the lever at B in clearing the signal breaks (at *b*) the unlocking circuit to station A, so that the signal at A cannot be cleared until B returns his lever to the normal position, and mechanically locks it there, although the unlocking circuit to A may be otherwise complete.

A short track circuit is placed in the track between the stations B and C, preferably near the station B, as indicated at F, in which is included the relay 14*b*. As the train enters upon this track circuit, this relay is opened, thereby breaking the unlocking circuit at (*l*). This break permits armature carrier 56, the magnet 46 being demagnetized, to swing out, thereby releasing arm 61, which then swings down to the intermediate position. This downward movement of 61 and consequent rotation of the rock shaft 35 will so move the arm 91 as to allow springs 88 and 89 to come together, they having been separated when 61 was raised; and the upward movement of arm 34, which is not sufficient to raise 33 from the opening in the plunger, will so shift arm 32*a*, that 40 and 42 will again come into contact. These contacts at *g* and *k* are completed without breaking the contacts at *f* and *h*.

As the train approaches station C, it enters upon the track circuit indicated at E, thereby cutting out the relay 14*c* and breaking (at *n*) the circuit through 114 and 141*c*, and at the same time completing a circuit through point 112, wire 113, binding post 72, wire 71, magnet 62, wire 70, binding post 55, wire 101, battery 102, wire 103, common wire 19, wire 114, and armature 110. By the closure of this circuit the armature of 62 is attracted, shifting arms 64 and 65; stop 66 is lifted, arm 61 drops, 67 checks it, and spring 74 is shifted into contact with 73, thereby closing a retaining circuit through the magnet 62. This retaining circuit runs through 73, 74, wire 75, binding post 76, wire 115, contact point 116 and spring 117 (*p*), wires 118 and 103, battery 102, wire 101, binding post 55, wire 70, magnet 62 and wire connecting the other pole of the magnet with contact point or spring 73.

The signal 3*c* is preferably located about midway of the track section E, so that the main circuit through magnet 62 completed by the entrance of the train section E, will not be broken by the passage of the train off the section until the train has passed by the signal. In clearing the signal for the onward movement of the train, the retaining circuit through magnet 62 is closed at *p*, and it is closed at *i* by the train. The retaining circuit having been closed by clearing the signal, it will remain in that condition until the signal lever has been shifted and locked in normal position, thereby through the medium of the sector block, forcing the spring 117 away from the point and breaking the retaining circuit.

While arm 61 is held up by stop 67, the banner is held in such position that the words "Train in Block" appear to the operator, a train being considered in the block between B and C until it has passed off of the track section E, adjacent to signal 3*c*, and the latter shifted to normal position. As stated, the passage of the train off of the track section E breaks the main circuit through magnet 62 at *o*, and the locking of the signal lever 1*c* breaks the retaining circuit through the same magnet, thereby releasing arm 65 so that it will drop down, releasing arm 61. The banner then drops and shows "Free" to the operator, indicating that he is now at liberty to unlock the signal at B. The downward movement of arm 61 not only raises the dog from the plunger and permits spring 39 to move back out of contact with the spring 40, but also so shifts arm 53 as to permit springs 51 and 52 to separate, or assume normal position.

As in the cases of stations A and B, the magnet 9*c* must be excited so as to lift finger 7*c* out of the path of the sector block. The circuit of this magnet consists of the wire 119, make-and-break mechanism *q*, common wire 19, wire 103, battery 102, wire 101, connected binding posts 55 and 86, wire 85, springs 83 and 84, wire 87, springs 88 and 89, binding post 90 and wire 122. It will be observed that the make-and-break mechanism *j* of this circuit is controlled by magnet 80, so that the circuit of this magnet must be closed before the circuit of 9*c*, can be completed. The circuit for the magnet 80 consists of the wire 94, binding post 95, wire 123 extending to the unlocking and indicating mechanism at station D, binding post 124, wire 125, springs 126 and 127 (*r*) wire 128, magnet, 129, wire 130, springs 131 and 132 (*s*) wire 133, binding post 134, wire 135, battery 136, wires 137 and 138, contact points (*t*) wire 141, contact point and armature 142 and 143 of the relay 14*d*, wire 144, common wire 19, extending back to station C, wires 103 and 118, contact spring 117, point 145, wire 146, binding post 93, and wire 92; or from common wire 19 the current may pass by 114, 110, 111. wires 141*c* and 146, binding post 93 and wire 92 to magnet 80.

The operator at C having asked the operator at D to unlock his (C's) signal lever, the operator at D will pull out plunger 30, thereby throwing up arm 61, so that its crossbar 60 will engage the spring pawl 59 and be retained thereby, provided that the cautionary circuit at D is closed. This circuit consists of the battery 136, wires 137 and 147, springs 148 and 149 (*u*) wire 150, binding post 151, wire 152, resistance coil 153, contact springs 154 and 127 (*v*) wire 128, magnet 129, wire 130, contact springs 131 and 132 (*s*) wire 133, binding post 134 and wire 135. The cautionary circuit must be closed so as to hold magnet 129 closed and prevent the dropping of arm 61, and consequent lifting of dog 32. As

before described, *s* is closed by an arm on the shaft 35, which is rotated by the plunger when pulled out. The return movement of the plunger will permit dog 32 to drop and press spring 126 against 127, thereby closing the circuit through magnet 80 at station C. The closing of this circuit so shifts the armature 79 (Fig. 7) as to press the springs 83 and 84, thereby closing, at *j*, (Fig. 1*a*) the unlocking circuit through 9*c*, and also shift the miniature signal 82 to clear, thereby indicating to operator at C that the operator at D has done his part toward unlocking lever 1*c*. Having received the indication that the unlocking circuit is closed at *j*, the operator at C presses upon the pin 155 in the floor, thereby closing *q* in the unlocking circuit. The closing of the circuit through magnet 9*c* lifts the finger 7*c*, and the operator at C is now free to shift his lever to clear the signal 3*c*.

The signal must, of course, be cleared to authorize the train to pass off of section E, and hence banner 97 will not drop to indicate "Free" until after the train has passed off of section E, and the signal 3*c* is restored to normal. As soon as the banner indicates "Free" the operator at C is at liberty to pull plunger 30 and unlock the signal lever at B so as to permit a train to enter the block between B and C.

It will be observed that the make-and-break mechanism *k* (springs 88 and 89) in the unlocking circuit of magnet 9*c* is opened by the movement of the rock shaft when C pulls out the plunger to unlock 9*b*. This makes it impossible for the operator at D to unlock C until by the passage of the train over track section F at station B, the rock shaft at C is permitted to rotate back sufficiently far to close *k*. The interposition of *k* in the unlocking circuit renders it impossible for all the operators along the line to unlock each other and set their signals at clear; for although C may shift his plunger to unlock B, he at the same time opens his own unlocking circuit at *k*, so that although D may shift his plunger to unlock C, the latter's unlocking wire (broken at *k*) will remain open until the train has passed over track section F.

Where there is a siding between two stations, with entrance as indicated at S in Fig. 1, it is necessary to provide means whereby a train at B may pass into the siding beyond the signal 3*b* and the track section F, without so locking up the unlocking and indicating mechanism at C, as to prevent the operator at C from unlocking B, after the train has entered the siding. As before stated, the passage of a train over track section F, breaks the unlocking circuit of B at *l*, and, the plunger 30 at C having been pulled out and released to unlock B, is on its return so locked by the dog 32, when the unlocking circuit is broken at *l*, that it cannot be unlocked, except by the passage of a train over the track section E. Hence it is necessary to provide means whereby the unlocking circuit from C to B, may be kept closed while a train is passing over track section F and entering the siding. This result is effected by means of a shunt circuit consisting of the wires 156 and 157 connected respectively to the wires 19 and 100 of the unlocking circuit and the make-and-break mechanism at *w*. This mechanism (*w*) is arranged to close when the movable rails of the siding are shifted to permit the entrance of a train to the siding. With this shunt circuit the unlocking circuit will be held closed while the train is passing over track section F, and hence the unlocking and indicating mechanism will not be locked.

The orderly movements of the several parts of the unlocking and indicating mechanism at D occurs as described in connection with the mechanism at C. The several circuits and make-and-break mechanisms described as before at C are also found at D, and at each block station along the line of the road.

To make the description more easily comprehensible we may now omit the references to the circuits and connections, and briefly review the operations which a signalman, say at C, performs in connection with the passage of one train. First, he must unlock B. This he does by pulling out the plunger. This lifts 61 and closes the cautionary circuit at *h* (which circuit, however, he does not complete unless his own lever 1*c* is locked normal, holding *m* closed) to hold up 61. Arm 61 being held up, the plunger is immediately pulled in by the spring. This lets the dog drop into the hole, locking the plunger, closing *f*, and opening *g*. (Opening *g* opens 46, but not until after 9*b* is closed). Closing *f* closes 9*b* and unlocks B's lever 1*b*. The train may then proceed. As the train passes F it opens *l*, thus opening 9*b* and 46. Arm 61 then drops one stage, closing *k* and *g* (*f* and *h* still remain closed), and showing the words "Train in Block."

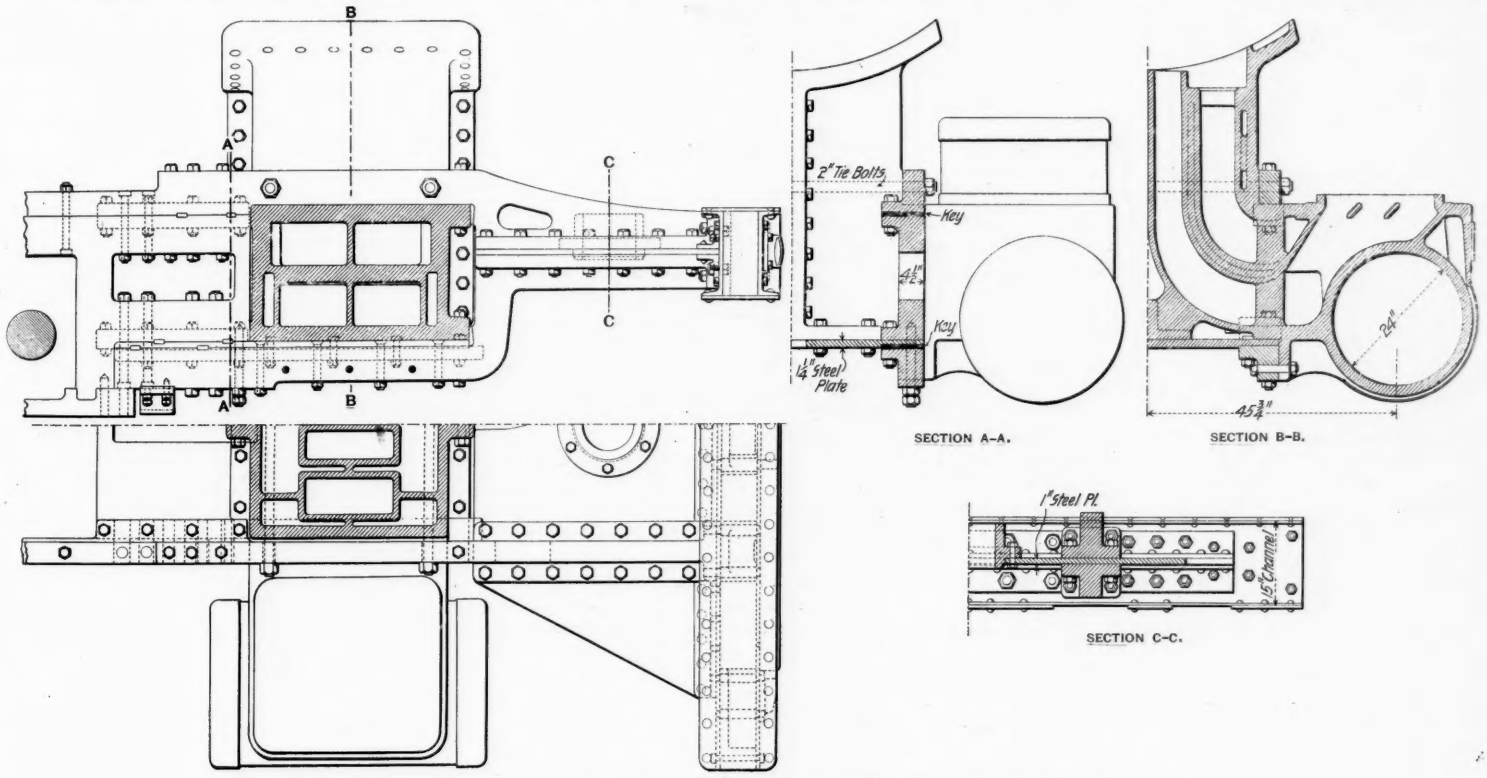
C having cleared his signal (by co-operation of D) the train comes on past 3*c*. At E it opens *n* and closes *o*. This closes 62 and arm 61 drops one more (short) stage. At the same time the retaining circuit is closed through 62 at *i*. This circuit was closed at *p* when the signal was cleared for this train. After the train has passed, *n* is closed; and the signalman returns lever 1*c* to normal, opening the retaining circuit at *p*; this opens 62, releasing 65, dropping 61 and showing the word "Free," meaning that B may be unlocked for a second train. The dropping of 61 raises the dog and frees the plunger; it also opens *g* and *h*.

The co-operation of two signalmen in unlocking will be seen by reference to *q* and 80. When D plunges, closing *r*, he closes 80 closing *j*; this clears the miniature semaphore and notifies C to close *q* (with his foot); this closes 9*c* and unlocks 1*c*.

The opening of *k* by C, when he unlocks B, prevents D from unlocking C until the train passes F and closes *k*.

Frame Connections of the Heavy Pittsburgh, Bessemer & Lake Erie Locomotives.

A general description of the new consolidation locomotives of the Pittsburgh, Bessemer & Lake Erie, built by the Pittsburgh Locomotive Works, was published in our issue of June 29, and a view during erection was shown July 20. We now give by line drawings the method of securing the cylinders and frames which is novel; perhaps this is the stiffest and most reliable front frame construction yet brought out.



Frame and Cylinder Fastenings—Pittsburgh, Bessemer & Lake Erie Consolidation Locomotives.

The frames are of cast steel and it will be seen these have lateral flanges for the connection of a transverse brace plate of 1¼ in. steel. This transverse plate goes from frame to frame and beneath the saddle, being bolted to the frame flanges along the sides and also to the saddle flanges. It extends from the front of the saddle to the jaws of the front pedestals so as just to clear the flanges of the front driving boxes. This plate makes a very stiff connection and transverse brace for the frame, and, the saddle being bolted to the plate, the frame connecting bolts are relieved of much of the strain to which they are commonly subjected. The central slot in this plate back of the saddle is to make room for the equalizer.

There is a similar transverse plate between the front frame members, extending from the front of the saddle to the back of the bumper beam and widening out at the forward end to nearly the full length of the beam. The front frame members have flanges on both sides, as shown in section C-C, for the connection of this brace plate. The bumper beam is made of two 15-in. channels with distance pieces between and the whole construction is so stiff that the usual inclined braces from the smoke box to the bumper beam are unnecessary.

Another important feature of this design is the vertical member, D, just back of the saddle which connects the upper and lower horizontal flanges of the main frames. This not only forms a rigid, rectangular construction but forms a substantial abutment for the rear side of the saddle. This feature of the frame appears to be entirely new, as these horizontal members, in all cases that we know of, have been disconnected and so are correspondingly loose. Special attention is called to the novel features of this design for, as a rule, the cylinder and frame connections of recent heavy engines are not sufficiently rigid.

Signaling of the Paris Fair Belt.

The electric railroad at the Paris Fair has the form of a belt-line around a quadrilateral of unequal sides. It is double-track and trains on each track run always in the same direction, under two minutes headway. In the beginning it was not thought practicable to use signals for this line, but the necessity of some form of protection for the trains led to the adoption of Timmis' system modified by the engineer of the electric road. It was decided to equip only the portions where the trains turn the corners of the streets and where a good view could not be obtained, and leave the straight lines without protection, and, with the exception of the shortest side of the quadrilateral, this was done. The train standing at a station just beyond a curve has an automatic block signal behind it, and in one instance there are two such blocks overlapping each other.

As might be supposed, this is a track instrument system worked by batteries and wire circuits. Owing to the constant current to be obtained from them, it was decided to use storage batteries, and the size chosen will allow them to run the signals a long time without recharging, possibly for the whole of the Fair. The signal itself resembles the old Gould-Tisdale form and consists of an arm covered with red cloth or celluloid mounted in a circular case with clear glass in front and opaque white glass behind. It is lighted by a single white light placed behind the arm. The arm in its horizontal position denotes the presence of a train in the block, and in its inclined position it denotes that the track is clear. The arm is held in the all-clear position by the constant passage of a current in the coils of an electro-magnet in the signal, and it goes to danger when this is interrupted.

When a train enters a block, a bar bolted to the side of the leading motor car of the train, separates two springs in a track instrument opposite the signal, and the arm falls to the horizontal position by gravity. When the train has gone 200 or 300 meters beyond a curve, or station (as the case may be) the signal is set clear by the train operating a second track instrument nearly like the first, except that it is so arranged as to close a circuit instead of opening one. The electro-magnet is thereby vitalized and brings the arm to the inclined position. By an arrangement of springs, etc., in the signal the larger part of the current is cut off when the signal has reached its all clear position (leaving just enough to hold it there) and the length of time the battery will go without recharging is thereby largely increased.

The protection afforded by these signals is only partial, as the blocks are not continuous and, with one exception, are therefore not overlapped, but for covering the trains on curves where no clear view can be obtained, are undoubtedly of great value.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

We give on another page considerable space to what is after all a very short summing up of the work and conclusions of the committees appointed by the Merchants' Association of the City of New York to consider the future supply of water for that great city. A similar work has been done also, part of it simultaneously, by Mr. John R. Freeman, whose report we mentioned August 3, page 528. These two reports supplement each other and together they make a very valuable body of information and opinion. Engineers all over the country will be interested in the summaries of information and opinion and still more interested in getting the reports themselves, if they are obtainable. It seems probable that an arrangement can be made by which a number of copies of the report of the Merchants' Association can be had for a small price. Such arrangement, however, has not yet been completed. We hardly feel called upon to compare these two important reports, yet we do not like to neglect the occasion to point out the advantages in practical work which one man has as compared with a committee. In definiteness, coherence and sense of responsibility for everything that is said and done the one man is pretty sure to beat a dozen men. An instance of the disadvantage of a committee will be found in the recommendation made by the Merchants' Committee on Water Supply with regard to the source from which water should be taken. It will be seen that all of the argument of the Engineering Committee and the argument as summed up by the General Committee leads up to the scheme of taking water from the Hudson River above Poughkeepsie and filtering it. Yet in the formal recommendations there is injected one for taking the water from the Adirondack source so worded as to lead the reader to suppose that the Poughkeepsie project is not approved. Technically, the water taken at Poughkeepsie is from the Adirondack source and thus the Committee may indirectly recommend the Poughkeepsie project. Probably the matter is not very important, but the necessity for conciliating various shades of opinion has weakened the report in more than one place; and yet, as a whole, it is an important and convincing document.

The Railroad and the Towns.

It is a commonplace that it is futile to enact laws to enforce upon men any higher standard of conduct than public opinion requires. Railroads are in such large degree public institutions that they feel the working of this principle very often. An illustration may be found in the grade crossing legislation of Massachusetts.

These statutes, beginning about 1890, followed the general rule that highways crossing railroads on the level should be changed as fast as possible, and that no new level crossings should be created. This theory was so clearly set forth that the state railroad commissioners made few exceptions to it, and those with the utmost reluctance. But the first new road that was proposed through a sparsely settled region, the Grafton & Upton, with thirty crossings, desiring to have the rule suspended, went over the heads of the commissioners to the legislature, and got the exception without difficulty. The spirit of the law was believed by the legislature to be too rigid, and the people along the line of the road were allowed to have their road, with its dangerous crossings, because it was believed to be better so than to have no railroad at all. The public has what it wants, if it knows how to get it, without much regard to abstract principles and possible injury to less important private interests.

Railroad men acquainted with recent improvements around New York city will recall an instance where a certain road was obliged to spend many thousand dollars more than it had planned to spend, and to delay the use of an important and costly improvement many months, because the officers of the company were too successful in repressing public opinion and in having their own way. The railroad company's plans, not satisfactory to the people, were adopted, and their execution was proceeded with; but the people kept up their agitation, went to the legislature, and finally got their own plan adopted.

Another recent instance, and the one which calls this subject to mind now, is that of a grade crossing —or a group of crossings—in Western Massachusetts. In depressing the streets and raising the tracks a few years ago the railroad engineers convinced the judicial body which settled the height of the bridges that a minimum head room was sufficient, and the bridges were so built. The municipal officers apparently withdrew their objections, or at any rate appear to have made no appeal; but being convinced against their will, they continued of their own opinion still; and now they have got the legislature to order the head room increased. The railroads will now have to raise four or more abutments and change the grade of a mile or two of double track, including two yards, at considerably greater expense than if the work had been done in one job instead of two. In their original negotiations with the municipal officials, like Japan in her war with China about that time, they gained an "unfortunate victory."

Purification of Feed-Water.

In another column is a short abstract of an elaborate report on the purification of feed-water for locomotive boilers, made by Mr. Aspinall to the International Railroad Company. The author is an engineer of exceptional experience; the plan of the report is sufficiently comprehensive to include every phase of the feed-water question, and the material of which it is composed has been drawn from all continents, save one. The exhibits of the report may, therefore, be safely accepted as an index to present tendencies in the world's practice.

It will interest the American reader to find that such a report, concerned with the general subject of feed-water purification, deals chiefly with systems involving chemical treatment of the supply, previous to its delivery to the locomotive tanks. Such processes have advantages which have long been understood by American engineers, and for this reason it is with a feeling of satisfaction that one reads the admirable statement constituting a part of the report, submitted by the Southern Pacific Railway, which discloses results that lose nothing when compared with those of roads of other countries.

But while for the purposes of the report the Southern Pacific saves the day for America, the fact remains that chemical treatment of feed-water before its delivery to the locomotive has not yet received general attention in this country. This does not imply that American practice is inferior to that of other countries, but rather that its development has proceeded along other lines. The American superintendent of motive power has employed chemicals in the boiler and in the tender, a practice which is but lightly touched upon by the report, but he has not stopped with this. He has applied liberal blow-off cocks to boilers, and has introduced such regularity in their use as to make blowing-off a system of itself. He has provided elaborate apparatus for washing boilers, by means of which hot water may be delivered in strong jets to all parts of the boiler, and having these facilities he resorts to frequent washing. It would appear from the report that the high order of the apparatus employed in this country to supplement the use of chemicals in locomotive tenders has no parallel in the character of similar apparatus common to other countries. It happens, therefore, that while others have been engaged in developing systems for the purification of water prior to its delivery to the locomotive, the American engineer has by means such as these, secured results which, with respect to cost of maintenance and to the degree of constancy with which locomotives are kept in service, probably compare well with those elsewhere obtained by other means.

The weakness of the whole process of chemical purification is in the imperfect character of the result. The fact is, that if purifying plants were installed all along the line of a railroad having water heavily charged with scale-making elements, their presence would not justify the abandonment of facilities previously employed in keeping boilers clean, though the frequency of blowing and washing would be reduced.

But conditions arise which make even an imperfect result worth its cost. Practice in the treatment of feed-water supply will continue to improve and until the urgency of the need is sufficient to justify the more expensive process of distillation, partial purification by chemical treatment will be accepted. It is likely, therefore, that the subject which has been so carefully elaborated by Mr. Aspinall will for some time to come merit the serious attention of American engineers.

Telephones in Railroad Signaling.

We mentioned last week the increasing use of the telephone on American railroads in block signaling. It appears that experiments in this direction are being made in Europe as well as in America. From a report by Mr. G. Wurtzler, Inspector on the Hungarian State Railroads for the International Railroad Congress, which is printed in the July number of the *Bulletin*, Vol. XIV., No. 7, we learn that on certain Hungarian railroads the telephone has been substituted for "signaling apparatus;" and we gather from the statements made, which, however, are not very precise, that this refers, in some cases at least, to block signaling. It is clear, however, that the officers of the Hungarian roads, and for that matter of all European roads, are exceedingly cautious in making any change which does away with the human attendant.

Mr. Wurtzler's paper begins with a brief review of the history and development of telephony, and a diagram is given showing the arrangement of Deckert & Homolka's graphitic telephone, as adopted by the Hungarian State Railroads. On some of the branch lines of the Hungarian roads portable telephones are carried on trains. With this apparatus a bamboo rod is carried, by which a man standing on the ground can make connection with an overhead telegraph wire. Incidentally, the author observes that the railroads of Austria have, "in accordance with an official regulation," substituted the space interval for the time interval method of running trains; and a description is given of the manner in which telephones are worked over the wires used for block signaling. Electro magnets having considerable self-induction, are used at the telegraph stations, where necessary, to prevent a telephone call or conversation being heard beyond the station to which it is addressed. The induction current will not pass through these electro magnets. In a code of rules for using the telephone for ordinary communications on railroad wires, which, we judge, is in general use in Hungary, and, perhaps, other countries, the procedure to be followed is laid down with great precision. Where an important communication is sent, one of the rules requires that a third station shall listen so as to correct any error of the sender or the receiver; though the lack of a controlling station "ought not to delay the transmission of an urgent message."

Mr. Wurtzler believes that the telephone will not supersede the Morse telegraph, for greater care is required to insure accuracy; and also because of the greater strain on the operators. He seems to regard this inferiority of the telephone as a conclusive handicap, "even if the receiving operators record the message in shorthand." We cannot make out, however, that these opinions are based on any extended experience.

Four pages of this report are devoted to a description of Gattinger's lightning arrester, which, it is said, protects telegraph or telephone instruments against atmospheric electricity so thoroughly that communication need not be suspended in time of storm. The State Railroads of both Austria and Hungary have used this lightning arrester with satisfaction, and the telephones are no longer disconnected during storms. On certain bell circuits Gattinger's arrester has been used for three years.

NEW PUBLICATIONS.

Universal Directory of Railway Officials. Published by the Directory Publishing Co., Ltd., London. United States: E. A. Simmons, Sole Representative, 697 Chauncey street, Brooklyn, N. Y. 8vo.; pages 563. Price, $2.50.

The sixth annual (1900) edition of the Universal Directory of Railway Officials has just been issued. It contains, as usual, a list of railroads of the entire world, with their mileage, gage, equipment and officials. The railroads are arranged geographically and are indexed alphabetically. There is also an alphabetical index to all the officials given in the body of the book. Owing to the war in South Africa, it was impossible to get recent accurate information of the railroads of the Transvaal and Orange River Colony, but the information given

about the railroads of the other countries is all from official sources. We have used this directory constantly since its first publication and have found it accurate, comprehensive and conveniently arranged.

Compound Engines.—A Series of Lectures, by F. R. Low, reprinted from *Power*. New York: Power Publishing Co., 1900. Flexible cloth; 52 pages; illustrations and index.

In these lectures Mr. Low studies the philosophy and the practice of compound engines in a simple, and yet, so far as he goes, thorough way. Indeed his little pamphlet deserves a permanent and convenient place on the shelves of any man who has occasion to know about this special development of steam engineering. We have before now mentioned Mr. Low's faculty for presenting difficult matters in a lucid way.

The Corporate History of the Pennsylvania Lines West of Pittsburgh.—Mr. S. H. Church, Assistant Secretary of the Pennsylvania Lines West of Pittsburgh, has just completed the preparation and publication of Vols. VII. and VIII. of the Corporate History of the Pennsylvania Lines West of Pittsburgh. These volumes complete the work begun four years ago, bringing it up to date. The record begins with the year 1832. The compilation covers something of the history of 242 corporations and the documents now published reach in number 3,008. These documents, with the editorial notes, make an aggregate of 3,706 pages and about 3,000,000 words. Other volumes will be published as the further growth of material justifies.

Purification of Feed-Water.*

BY MR. J. A. F. ASPINALL.

In answer to inquiries, replies were received from 69 roads, representing 15 different countries. The questions sent out define the scope of the inquiry. They were as follows:

1. What process have you for softening or purifying water?
2. Give particulars of the process, materials used, etc.
3. What is the cost of softening per 1,000 English gallons?
4. Give an analysis of the water before and after treating.
5. What is the nature of scale produced from your unsoftened waters?
6. If possible give analysis of the scale and the water producing it.
7. Do you insert any material into your boilers for the prevention of scale? If so, of what does it consist?
8. Are you troubled with pitting of boilers or tubes?
9. To what do you attribute the pitting action?
10. In what part of the boiler does the pitting occur, and what is its condition as regards scale?
11. In what part of the boiler does the feed pipe deliver? Do you notice any increase of pitting at this point?
12. What metals are used in the construction of:
    (a) Boiler barrel?
    (b) Fire-box?
    (c) Tubes?
13. What lubricant is in use for cylinder lubrication?
14. Have you used zinc blocks or plates for the prevention of scale?
15. How are these attached to the boiler and what results did you obtain?
16. What is your method of washing out boilers? Is cold or hot water used?
17. If hot water is used, what is its temperature and in what way is it heated?

The number of roads in different countries which are reported as having sent replies, the number resorting to chemical treatment of water, and the average cost of such treatment is shown by the table:

The Cost of Purifying Feed Water.

Country.	Number of Roads Replying.	Number of Roads Using Purifiers.	Average Cost Per 1,000 English Gallons (Cents.)
Argentine	2	1	12.0
Austria-Hungary	6	5	7.0
Belgium	3	1	1.6
Egypt	1	0	...
France	8	6	4.7
Germany	1	0	...
Great Britain	22	7	2.0
Great Britain (Colonies)	7	1	...
Italy	3	1	1.3
Norway	1	0	...
Netherlands	3	1	1.1
Roumania	1	0	...
Russia	4	1	27.2
Spain	1	1	5.0
Switzerland	1	0	...
United States	5	1	3.3

From the statement of the practice of 26 roads employing chemical processes, the following are selected as fairly representative of the whole:

Buenos Ayres Great Southern Railway (Argentine Republic):—Use the "Tyacke" apparatus, softening 2,000 gallons an hour. The process consists in the addition of quicklime and caustic soda to the water to be purified. The fluid reagent and the water to be treated being regulated to a fixed quantity per hour.

The cost, including pumping, is 12 cents per 1,000 gallons. The analysis before and after treatment is as follows:

	Before.	After.
Calcium carbonate	10.78	2.52
Magnesium carbonate	7.35	5.74
Sodium carbonate	None	7.07
Calcium sulphate	2.03	None
Calcium nitrate	2.87	None
Silica	2.52	3.08
Hardness	25.°	9.8°
Scale deposited on evaporation	21.	9.5

*Abstracted from a "Report on the Question of the Purification of Feed-Water of Locomotives and the Use of Disincrustants (Subject XV. for Discussion at the Sixth Session of the International Railway Congress)," by J. A. F. Aspinall, General Manager, Lancashire & Yorkshire Railway, Manchester, England.

Southern of Austria:—The "Beranger and Stingl" apparatus is used at Vienna, Modling and Voslaw, the reagents used being milk of lime and soda, with subsequent filtration. At Vienna about 66,000 gallons are purified in from 13 to 14 hours, and the apparatus consists of two reagent tanks, each of 8,800 gallons capacity, from which the reagent is pumped into a small mixing chamber of 880 gallons capacity, and from thence through a large mixing chamber (1,320 gallons), into five cylindrical filters of 2,200 to 3,300 gallons capacity, the purified water being stored in two tanks, each of 19,800 gallons.

The cost is 7 cents per 1,000 gallons. The analysis before and after treatment is as follows:

	Before.	After.
Lime	13.72	1.4
Magnesia	8.61	3.7
Combined carbonic acid	13.02	1.0
Total hardness	44.64°	11.7°

Hungarian State—Use the "Stingl-Beranger" apparatus and also the "Pollacsek." The reagents are soda and lime. The "Pollacsek" apparatus consists of a tank of about 12,100 gallons capacity, divided into two compartments by a wooden bottom, the lower of which having a capacity of 3,080 gallons, receives the purified water. The unsoftened water is pumped into the upper compartment, and is delivered by a perforated pipe into a metal trench also perforated and containing the reagents. These dissolve and fall into the tank, where they are stirred up by mechanical means, and then pass out through four filters filled with sponge waste, which syphon off the treated water into the bottom compartment.

The cost per 1,000 gallons is from 2 to 3 cents for the Stingl-Beranger process and 5 cents for the Pollacsek process. The analysis before and after treatment by the latter process is as follows:

	Before.	After.
Calcium carbonate	14.35	6.23
Calcium sulphate	11.76	...
Magnesium carbonate	12.11	11.41
Silica	0.91	0.77
Total dissolved matter	54.46	47.60
Total hardness	37.2°	19.7°
Permanent hardness	13.6°	...

French State Railroad.—This road in its reply gave descriptions and sketches of three different systems:

1. An intermittent system, in which the water is mixed with lime and carbonate of soda, and allowed to settle 12 hours, after which it is filtered:

2. Stingl-Beranger purifier.

3. "Gaillet" purifier. This consists of a rectangular box, furnished with baffle plates which collect the deposits and allow of their removal by means of suitably disposed draw-off cocks.

The average cost for material and labor is 9 cents per 1,000 gallons. The analysis before and after treatment by the Beranger-Stingl process is as follows:

	Before.	After.
Calcium carbonate	10.15	3.50
Magnesium carbonate	5.74	1.05
Calcium sulphate	5.25	0.98
Magnesium sulphate	2.17	0.84
Total hardness	31.°	8.°
Permanent hardness	29.°	8.°

Eastern of France:—If the hardness does not exceed 35 degrees, soda alone is used; above this milk of lime is used to separately precipitate the bicarbonate of lime. These reagents after being mixed together are mechanically mixed with the water to be purified in the proportion of 1 to 25. This mixture is then run into settling tanks, where the water is drawn off from the surface by a floating pipe. This preliminary purification is only carried out at one depot.

The cost is 3.8 cents per 1,000 gallons. The analysis before and after treatment is as follows:

	Before.	After.
Total solids	47.88	37.8
Calcium carbonate	21.21	6.02
Magnesium carbonate	9.38	7.91
Calcium sulphate	10.51	...
Alkaline salts	...	18.97
Total hardness	46.2°	15.4°
Permanent hardness	21.7°	8.4°

London & North Western:—Use Clark process with modifications of same by Messrs. Porter and Howatson. Lime, or lime and sodium carbonate are added to the water, and the resulting precipitate separated by filtration or subsidence.

The cost for chemicals only is 0.2 cents to 4.0 cents for 1,000 gallons. The analysis before and after treatment is as follows:

	Before.	After.
Calcium carbonate	17.3	1.4
Magnesium carbonate	0.8	0.6
Calcium sulphate	1.1	1.
Silica, alumina, etc.	0.3	0.1
Total scale-forming matter	19.5	3.1
Total dissolved solids at 212° F.	23.	6.5
Total hardness	21.2°	3.6°
Permanent hardness	3.6°	1.6°

Midland Railway:—The "Archbutt-Deeley" process. This is a rapid precipitation process, using as reagents lime and sodium carbonate. The purification is carried out in tanks, and the freshly precipitated matter is agitated (by means of air supplied through perforated pipes at the bottom of the tank) along with some of the precipitated matter obtained from previous operations. The fine precipitate adheres to the coarser particles and settles rapidly. The supply is drawn off from the surface, and an arrangement is provided to carbonate the purified water, with a view to prevent further precipitation, due to the reaction between the calcium hydrate and magnesium carbonate not being quite complete at ordinary temperatures.

The cost for chemicals only is from 1 to 4 cents per 1,000 gallons. The analysis before and after treatment is as follows:

	Before.	After.
Calcium carbonate	8.46	2.47
Magnesium carbonate	1.05	0.21
Calcium sulphate	3.65	Nil
Magnesium sulphate	2.89	1.74
Total scale-forming matter	13.16	2.68
Total dissolved solids	22.30	14.30
Total hardness	14.7°	4.2°

Netherlands State Railroads:—At Maestricht, whilst the water is being pumped into a reservoir, a solution of soda is added to the feed-water at intervals of two hours, by a small auxiliary pump at the rate of 35.27 pounds per 22,000 gallons of feed-water.

The cost is 1.6 cents per 1,000 gallons. The analysis before and after treatment is as follows:

	Before.	After.
Calcium carbonate	18.76	5.74
Calcium sulphate	8.82	7.84
Magnesium sulphate	11.34	11.34
Total hardness	34.7°	...
Permanent hardness	21.°	...

Vladikavkaz Railroad (Russia):—Annually purify 77,000,000 gallons, this being carried out at ten stations. The Beranger-Stingl apparatus is used, with one exception, where an apparatus consisting of a closed purifying cylinder provided with cones is in use, in order to completely remove all impurities, the water afterwards passing through a system of 16 filters.

The reagent used in caustic soda solution (it not being possible with the apparatus used by this railway to use lime and soda) and this removes the magnesium bicarbonate and sulphate. As a consequence of the reaction between the caustic soda and magnesium bicarbonate, sodium carbonate is produced in sufficient quantities to remove part of the calcium sulphate which is present in the water. The reaction is complete in from ¾ to 1 hour. The total capacity of the four cylinders of the Beranger-Stingl apparatus is about 4,620 gallons and 1,540 to 1,760 gallons is purified per hour.

The cost is from 10.2 cents to 44.2 cents per 1,000 gallons. The analysis showing effect upon water containing small quantities of magnesium salts is as follows:

	Before.	After.
Residue dried at 248° F.	70.84	50.40
Magnesium carbonate	6.17	Traces
Calcium carbonate	9.	Nil
Calcium sulphate	19.41	7.63
Total hardness	30.6°	5.6°
Permanent hardness	14.3°	5.6°
Sodium carbonate	...	10.44

The analysis showing effect on water containing large quantities of magnesium salts is as follows:

	Before.	After.
Residue dried at 248° F.	217.56	221.06
Magnesium carbonate	22.34	Nil
Magnesium sulphate	25.15	24.94
Calcium sulphate	39.19	6.02
Total hardness	74.2°	24.5°
Permanent hardness	47.6°	24.5°
Sodium carbonate	...	34.13

Southern Pacific Railway:—Use a process based on the chemical principles of the Porter-Clark process. It consists of injecting into the main or supply water pipe under pressure, condensed solutions of the desired chemical reagents, from chemical tanks, suitably placed and connected with the water main by feed pipes. There are two stations, one at Port Los Angeles and the other at El Paso.

At the Port Los Angeles station the cost is 4 cents per 1,000 gallons, and 1.9 pounds of lime and 2.4 pounds of soda ash are used for each 1,000 gallons treated. The analysis of water in solution in grains per gallon, before and after treatment is as follows:

	Before.	After.
Carbonate of lime	17.15	0.80
Sulphate of lime	6.08	0.35
Carbonate of magnesia	1.46	7.15
Sulphate of magnesia	20.58	1.95
Silica	1.61	0.13
Alumina and iron oxides	0.20	0.20
Alkali sulphates	4.27	33.50
Alkali chlorides	10.50	6.85
Total solids (dried)	61.85	50.93
Total scaling salts	47.08	10.58
Permanent hardness	21.51°	9.38°
Temporary hardness	18.90°	1.87°
Total hardness	40.41°	11.25°

Another section of the report refers briefly to systems of treatment involving the use of chemicals in the boilers or tanks of locomotives but does not emphasize them. Chemicals thus used are referred to as "disincrustants." From replies received it appears that in most cases disincrustants consist of, or contain, sodium carbonate, the action of which is to convert calcium sulphate, the presence of which results in the formation of a hard scale, into calcium carbonate, and to precipitate it in the form of mud. Caustic soda is also used.

In addition to these saline anti-incrustants, others consisting of various organic matters are in use. This, on one of the Belgian lines, is added in the form of potatoes, but most generally these organic compositions are composed of tannate of soda or of tannin in the form of quebracho wood extract, etc., along with sodium carbonate, etc. These tannin compositions find most favor on the Argentine and French lines. A composition consisting of eucalyptus (infusion of blue gum leaves) is used by the New Zealand Government lines.

Petroleum is in use on several lines, principally on the Austrian and Russian railroads, and acts mechanically, preventing the precipitated matter adhering by coating each particle with a minute layer of oil.

The report deals in a most elaborate manner with the subject of pitting, many of the replies being very full. Among causes assigned are (1) the presence of acids in the water; (2) presence of dissolved gases in the water; (3) galvanic action; (4) local alteration in the metal caused by flanging, punching, etc., and to mechanical strains incident to service; (5) friction caused by wash-

out rods; (6) the presence of grease or fatty oil; and (7) to the action of iron on water at high temperature.

Out of 63 replies to the group of questions concerning boiler washing, 26 report the use of hot water; the remaining 37 use cold water. In the majority of cases using hot water no special apparatus is employed for heating, water being supplied by injectors drawing water from the tender of another locomotive, the steam used for working the injector serving to heat the water to a temperature of from 120 degrees to 140 degrees F. Four roads are especially equipped for washing with hot water, and others generally using cold yield to the practice of using hot water in the case of boilers having steel fire-boxes.

Works of the New England Gas & Coke Co.

The works of the New England Gas & Coke Co., from which the coke used on some of the New England railroads, as described in a recent issue, is obtained, are at Everett, Mass., near Boston. They are both elaborate and simple; elaborate in that they are equipped for the handling of large quantities of material, and simple in that the apparatus used differs principally from other gas and coke works in size only.

The coal used is Nova Scotia coal as mined by the Dominion Coal Co., and is not suited to use in locomotives. It is received by steamship, and is hoisted into storage bins of 6,000 tons capacity. This coal shed, with the hoists above it, is to be seen at the right of the engraving.

From the bins in this shed the coal is loaded through chutes into lorreys, which are hauled up the two inclines to the bins over the ovens. There are four of these, one for each battery of ovens, two of which appear in the center of the engraving. The lorreys are hauled up the incline by a cable, and are dumped at the bins by a tender.

Beneath these bins there is a track running the length of each battery of ovens, over which a charging lorrey travels. This charging lorrey receives its load from a hopper in the bin, and is run to a point over the oven to be charged.

There are 400 of these ovens divided into eight batteries of 50 each. They are lined with firebrick, and are surrounded with flues at the top, bottom and sides. The ends are closed by sliding doors that can be raised or lowered, and which are hermetically sealed with mud while the coking is being done. The ovens are heated by the gas that is distilled from the coal during the later hours of the coking process, after it has ceased to be of value for illuminating purposes. The charging and discharging apparatus is so arranged that the ovens are never allowed to cool.

The charging is done at the top, as already described. In order that the discharging may be done with the least possible expense the ovens are raised to such a height that the floor is well above the sides of a steel car into which the hot coke can be pushed.

The doors of an empty oven are lowered and sealed with mud. The coal is then dumped in from above, and leveled off with a spud, through a hole in the back door, by the man in charge of the pushing machine. This done, the hole is closed, and the coking process continued for about 31 hours. The doors are then raised at each end of the oven and the receiving car run opposite one end, while the pusher is placed in a line with the oven at the other. The pusher is carried on an elevated track, and consists of a ram whose head is of about the same dimensions as the cross-sectional area of the furnace. The stem of this ram carries a rack meshing with a pinion driven by an electric motor, by which the ram may be moved to and fro. By sending this ram in at one end of the oven the charge is pushed out at the other across a narrow attendants' gallery into the receiving car. Here it is cooled by a stream of water.

Outside of and below this receiving car there is a railroad track, upon which cars for carrying away the coke are placed. They have the general appearance of gondola cars with an extension of their sides in the form of a rack. The sides are fitted with doors opening outwards, and the floor is raised into a ridge along the center so that the load is self-discharging. The receiving car has a sloping floor enabling the coke, received from the ovens, to be discharged into the top of the cars on the track beneath.

The provisions made for the collection and conveyance of the gas distilled from the coal are equally simple and effective. Over each battery of ovens there is a large gas main with connections leading down into the top of each oven. This main is carried by the trusses that extend out on either side of the coal bins. These pipes are raised at the center and slope down on either hand for the purpose of allowing the tar to flow off by gravity.

The globules of tar that permeate the body of gas, as it rises from the ovens, are rapidly precipitated, and the liquid thus formed is collected in an open trap, whence it flows by gravity to a neighboring tar works, by which the whole product is taken and utilized.

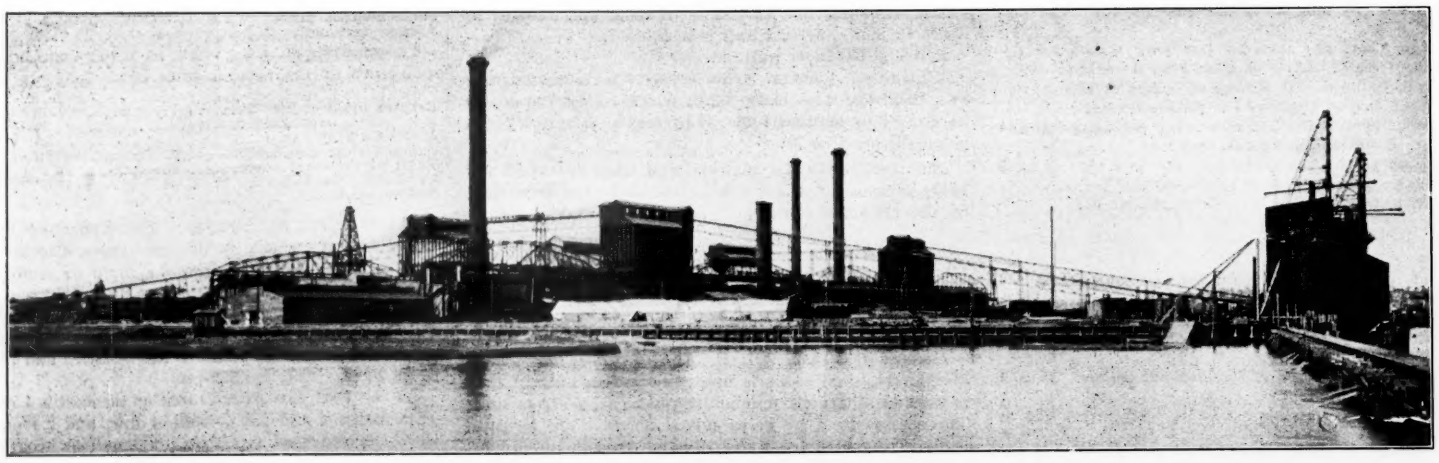
The gas, freed from tar, is then led through the cooling and scrubbing apparatus after the manner usually followed in the manufacturing of illuminating gas, and is thence led to an immense gasometer of 5,000,000 cubic feet capacity for general distribution.

The gas liquor formed in the scrubbers is, of course, saved, and from it is made the sulphate of ammonia, which is extensively used in the manufacture of fertilizers.

The salable output of the establishment consists of five things: Coke, illuminating gas, tar, sulphate of ammonia and a very small quantity of gas for power purposes, the needs of the plant taking almost the entire output of the last.

Power is furnished to the several departments by a Siemens & Halske generator driven by a direct connected steam engine. Electricity is used as the motive power throughout the whole plant. Steam for the engine driving the generator is supplied by a battery of water-tube boilers, which are heated by gas supplemented by a light fire of coke.

The works are so situated that they have excellent shipping facilities both by water and rail. There is also ample ground in the immediate vicinity for an extension of the plant. With the ovens running to the full capacity the coal consumption would average about 1,700 tons each 24 hours, allowing each oven to be charged with 6 tons of coal, and provided that each charge should average 32 hours per oven. The rate of coke production to coal consumption is about as 7.5 to 10, or, to be more exact, 11,700 pounds of coal will yield 8,740 pounds of coke. The quality of the coke and the methods employed in burning it in locomotive fire-boxes have already been described, and this is a matter not only of interest but of great importance to railroad men who are called upon to deal with the problem of smoke prevention.



Works of the New England Gas & Coke Company.

Some Handy Appliances for the Shop and Road.

The constant demands that are made upon railroad mechanics to meet the emergencies and conditions of the service in which they are engaged results in a constantly increasing development of special devices, some of which are patented and put on the market, while the sale for many others would be too limited to warrant the expense of exploitation. We give in this connection a few that have been gathered from various sources, and which will be worth imitating and adapting to their own use by many of our readers.

In Fig. 1 is shown a renewable plate for lining out the worn hubs of locomotive driving wheels that is in use on the Delaware & Hudson. On that road it is made of steel, but it is evident that brass can be used as well. The peculiar feature of the arrangement is that while it is made in halves so as to be readily set on over the axle, the two parts are made to so interlock with each other that they can only be separated by slipping them past each other on a line parallel to the axis of the axle.

Still another device culled from among those of the Delaware & Hudson is a valve stem clamp (Fig. 2) to be used on the road when an accident necessitates the disconnecting of one side of the engine. It consists of two clamps having V-shaped notches that are securely fastened to the valve stem by a bolt on either side. This is done after passing the gland studs through the two slotted holes whereby any longitudinal movement of the stem is prevented by screwing down the nuts on the studs.

The gland studs are also used on the same road to hold an oil cup (Fig. 3) for the lubrication of the piston rod or valve stem. The cup is cast of brass, and has a span with slotted holes arranged to fit over the gland studs where it is to be used. The opening at the bottom is closed by a piece of wicking that extends far enough beyond the metal to come in contact with the rod to be lubricated, where it acts as a wiper taking the oil down by capillary attraction.

The cheap and quick lighting of fires in locomotive fire-boxes is a problem that every master mechanic has been called upon to solve, and which he has done with more or less satisfaction to himself and his employers. On the Missouri Pacific compressed air with oil has been successfully employed in the apparatus shown in Fig. 4. This arrangement is by no means unknown to motive power men, and it is not always approved; but its utility in this instance justifies a description in detail. It consists of a tank A slung between a pair of handles and carried on two wheels, with connections for forcing out and spraying the contained oil.

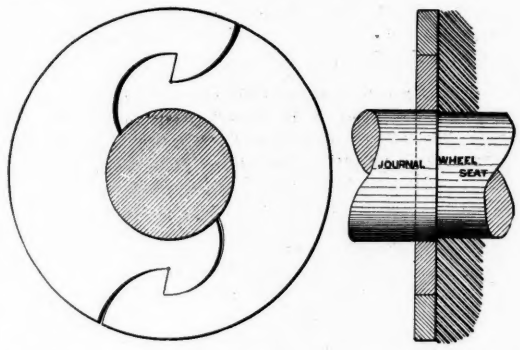


Fig. 1.—Lining for Worn Driving Wheel Hubs, Delaware & Hudson Co.

In operation the tank is wheeled alongside the engine and the hose B connected to the source of compressed air supply. By opening the valve I the air is allowed to pass down into the tank, creating a pressure on the surface of the contained liquid and also to follow the direction of the arrow into the hose D. The pressure exerted upon the liquid is indicated by the gage, and can be regulated by the valve I. When the plug cock J is opened the oil is forced up the pipe C and into the hose E. The sprayer H is placed at the ends of two pieces of pipe through which the flow of air and oil is regulated by the valves G and F, respectively.

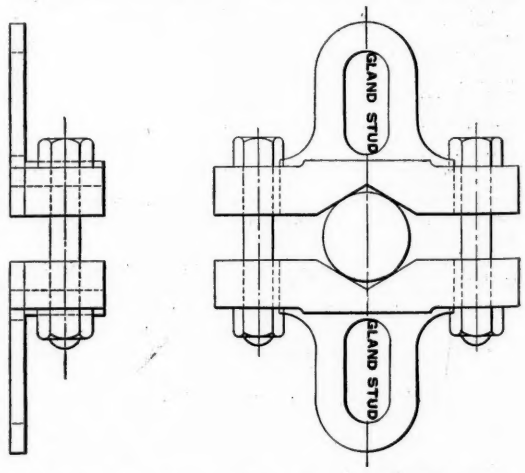


Fig. 2.—Valve Stem Clamp, Delaware & Hudson Co.

When the air and the valves have been opened the spray of oil issuing from H is ignited, and the flame thrust in at the fire-box door and down against the bed of coal that has previously been put upon the grates.

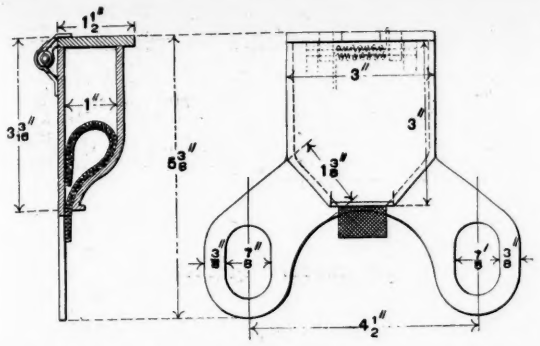


Fig. 3.—Valve Stem or Piston Rod Lubricator, Delaware & Hudson Co.

The nozzle is then moved over the surface until the whole is ignited, an operation that requires about fifteen minutes, after which the raising of steam is carried on in the usual way, except that compressed air is sometimes admitted to the blower pipe to assist the draft.

Some one connected with the locomotive shops of the Canadian Pacific in Montreal is responsible for the shearing machine illustrated in Fig. 5. It is used for shearing comparatively small sections of round and square iron where large quantities are to be cut, as in the making of bolts. Speed in operation was the principal requisite held in view in its design, and this speed amounts to the cutting of 60 pieces per minute.

The construction of the machine is exceedingly simple. It consists of a base A with two pillow blocks carrying the boxes that form the bearings for the shaft B. This shaft overhangs at one end, and there carries a heavy fly wheel and a tight and loose pulley. At one end of the shaft there is an arm C fitted with a hook-shaped cutter, as shown in the detail. The length of the bar that is cut off is regulated by the stop E that is adjusted to the desired position along the bar D. The latter is graduated to quarter inches so that the setting is quickly accomplished.

In operation the bar is thrust against the stop E, and is sheared between the cutter and the plate F, the flywheel serving to maintain uniformity of speed, and enable the machine to do very rapid work.

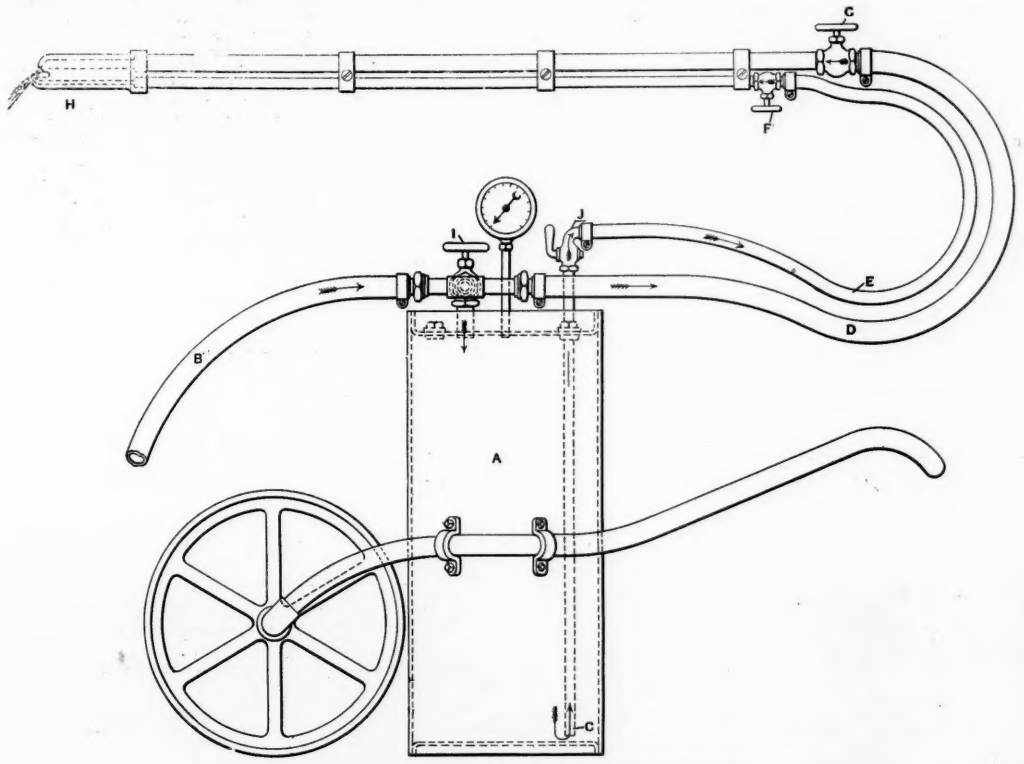


Fig. 4.—Locomotive Fire Lighter, Missouri Pacific Ry.

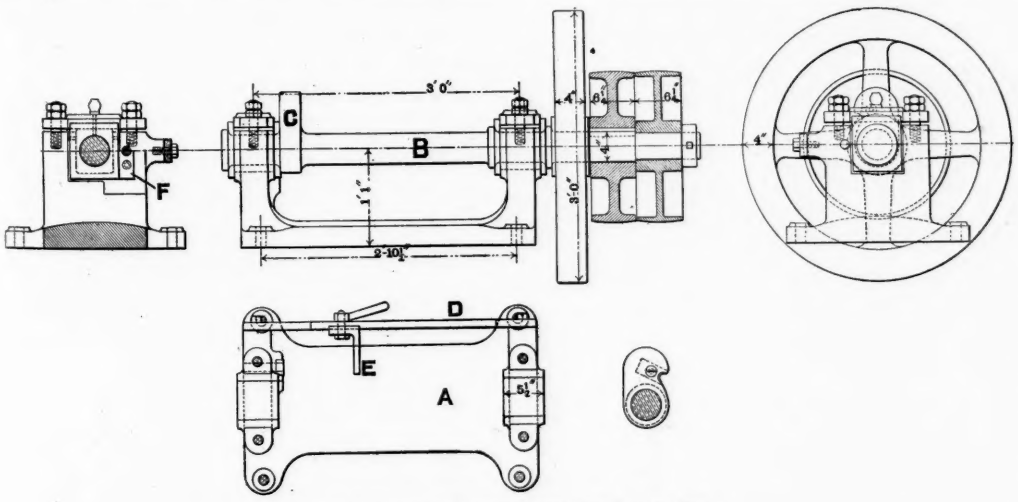


Fig. 5.—Rotary Shear—Canadian Pacific Ry.

Some French Notions on Signaling.

On the state railroads of Belgium, it has been the practice of locomotive engineers, especially when trains are behind time, on finding a distant signal at danger to hasten, if possible, the opening of the route by repeated blasts of the whistle, as soon as they perceive that the signal is against them. In consequence they have neglected to reduce speed at a distant signal and collisions have sometimes resulted from the inability to stop the train when the home signals or the disc stop signal is discovered set against the train. A French paper points out the danger of this practice and insists that a *stop* at the distant signal which is found against the train when sighted, is a necessary precaution. Hence, the practice proposed by some engineers, of allowing trains to pass a distant signal at danger without stopping is open to very serious criticism, especially as it prevents the use of torpedoes automatically placed on the track when the signal stands at danger, and this destroys the only means of protection existing when the red glass of the semaphore chances to be broken, which then shows the white light of the clear signal. [An accident was caused in this way on the North Belgian State railroad at the junction at Mons, Oct. 25, 1895.] Also there is no means of knowing whether the passing of the signal at danger at full speed may not be due to neglect to observe the signal at all. It necessitates, too, the flagging by hand of every train stopped between the distant signal and the next in advance.

There is also likely to be confusion between the positive block signals and the permissive block signals, and inability to avoid a collision when it is too late discovered that a signal has been over-run that should have been regarded as a positive block. No such strain should be put on the reason and judgment of an engineman as to require him instantly to distinguish and decide between signals that are nearly or quite alike in form, but different in function and governing power.

TECHNICAL.

Manufacturing and Business.

Jay G. Robinson has resigned as Chicago representative of Brown & Co., Incorporated, of Pittsburgh. He is succeeded by Charles Kennedy, who, for several years, represented the company in St. Louis, and later in New York.

The works of the John Stephenson Co., Ltd., at Elizabeth, N. J., which were sold at auction, June 12 last, have again started up under the direction of a new company formed by the syndicate that bought the plant. The directors of the new company have not been elected.

W. W. Taberner, formerly General Agent of the Armour Car Lines, has been elected Vice-President of F. M. Pease, Incorporated, 355 Dearborn street, Chicago. This is a company dealing in railroad supplies, particularly rails, locomotives and cars, and also handling bonds and car trusts.

Among the orders recently booked by the Bethlehem Steel Company are spare propeller shafts for the steamers Ponce and San Juan of the New York & Porto Rico Line, eight forged hollow shafts of fluid-compressed open hearth steel for Cuban sugar mills. They are also making gun barrels for the Winchester Repeating Arms Co. and Colt's Patent Fire Arms Co., of Bethlehem nickel-steel.

The Pearson Jack Co., Boston, Mass., makers of the Pearson car replacing jack and other specialties, has acquired from the United States Car Moving Device Co., Lowell, Mass., a license to make and sell in the United States and foreign countries, the U. S. car pusher. In connection with the announcement of this transfer the company has issued a circular of recent testimonials showing the success with which the new device has met.

Iron and Steel.

The Globe Iron Co., of Jackson, Ohio, is building a new furnace to be completed in December.

The Keystone Tube Co. has been incorporated at Newark, N. J., to manufacture iron and steel.

The Virginia Iron, Coal & Coke Co. has made a mortgage to secure $700,000 in promissory notes.

The Aschman Steel Casting Co., of Sharon, Pa., manufacturers of open-hearth steel castings, is building a new furnace.

The first shipment of steel columns for the New York City Rapid Transit tunnel reached Jersey City, Aug. 15. They will be used on section 13, extending from 139th street and the Boulevard to 181st street.

The American Rolled Steel Car Wheel Co. was incorporated in New Jersey, Aug. 14, with a capital stock of $300,000. John R. Jones, Thomas S. Boone, Daniel Gallagher and H. R. Nyce are incorporators.

Application will be made in Pennsylvania, on Sept. 8, for a charter for the National Foundry & Supply Co. The incorporators are: E. H. Dermitt, A. H. Lang, W. S. McKee, George B. Lang and Herbert Overly.

Pneumatic Tool Litigation.

We have from the Standard Pneumatic Tool Co. the following letter which explains itself:

"Inasmuch as it has been called to our notice that a large number of users and prospective users of pneumatic tools are under the impression that suit has been entered against us by one of our competitors for infringement of their patents on account of the fact that they have brought suit against various pneumatic tool companies, we wish to notify the trade in general through your publication that we are not involved in any way, shape or manner in the present litigation, as our 'Little Giant' pneumatic tools are fully covered by patents, the validity of which is not questioned by any one."

The Metropolitan Railway Electrical Equipment.

The electrical advisers of the Metropolitan (London) (Sir W. H. Preece and Sir J. Wolfe Barry) recommend a site at Chelsea Creek for generation station. For the transmission of electrical energy therefrom to the line conductors placed in cast iron boxes measuring 15 in. x 9 in. and laid 2 ft. below the surface will be employed. It is considered that it would be unreliable to use only one cable, therefore two will be laid, one underground and the other along the border of the land of the Chelsea Electricity Supply Company. The latter will be an alternative route.

The New East River Bridge Approaches.

A preliminary injunction was granted Friday of last week against the East River Bridge Commissioners restraining them from awarding contracts on the bids recently received for the Brooklyn and Manhattan approaches of that bridge. The order was returnable Thursday of this week and was granted by Justice Fitzgerald. Three points are alleged. First, that the contract provides that the successful bidder shall comply with the labor laws and pay the prevailing rate of wages. This, the complaint says, is illegal because it puts the contractor at the mercy of labor unions and compels him to charge the city more for the work than if he were allowed to hire his labor in the open market. Second, the specifications require that the steel shall have a certain chemical composition as to phosphorus, sulphur, manganese and silicon. It is alleged that steel of this quality is "made by a secret formula and can only be produced by one company, the Carbon Steel Company." Further, it is complained that the Commissioners stipulate that no bids shall be received from any contractor who has not been engaged in bridge work for at least a year. We should not expect this injunction to be made permanent. Of course, the statement about the steel being made by a secret formula is nonsense and will not bear five minutes' investigation. The third provision, designed to secure

responsible and experienced bidders, will doubtless be ruled upon as wise and proper. The validity of the prevailing rate of wages clause of the labor law ought to be passed upon, but we question if the Court will hold that this is the time and place to adjudicate that matter.

Is the M. C. B. Coupler a Success?

In the Question Box of the Pacific Coast Railway Club this question was found: Is the M. C. B. vertical plane coupler a success? Has it come to stay? To this Mr. Burkhalter, Division Superintendent Southern Pacific, answers: "I have yours of the 22d, advising that Mr. Small has referred to me for answer to the question. You will have to excuse me from this, as writing editorials is not my forte. Had the question referred to the California coupler it would have been easy. I presume the M. C. B. has come to stay until displaced by something better, and I sometimes think it a pity that the Miller hook was invented too early." From this judicious answer we may get such comfort as it yields.

The Massena Water Power.

Despatches from Massena, N. Y., say that the work towards developing the water power there for the manufacture of electric current is progressing satisfactorily. It is believed that electric power will be developed by Jan. 1, 1901. The canal has been pushed fast and the excavation for the power house is completed.

The Hardie Motor Cars in New York.

We have announced before this the fact that the compressed air motor cars running on Twenty-eighth and Twenty-ninth streets in the city of New York, being the Hoadley-Knight motors, are to be replaced by Hardie motors, which latter are built at the Rome Locomotive & Machine Works. Seventeen of these Hardie motor trucks have reached New York and the car bodies are being transferred to them. They have to be repainted and furnished up, which necessarily takes a little time. Meanwhile, new tracks are being laid on Twenty-eighth and Twenty-ninth streets to replace the old horse car tracks. The new motor cars will be run on Twenty-third street as fast as they are ready to go into service. That, we suppose, is to break them in, which can be conveniently done on Twenty-third street now as the travel is not as heavy as it will be a little later in the season, and these air cars can be run between the electric cars.

Interlocking.

The Taylor Signal Co. has closed a contract for interlocking the crossing at Chicago Heights of the Elgin Joliet & Eastern and the Chicago & Eastern Illinois.

New Pumping Plant for Navy Yard.

The Navy Department is advertising for bids for a new electric pumping plant for timber dry dock No. 3 at the Brooklyn Navy Yard. The amount allowed is $80,000. Bids are to be opened at 1 p. m. on Sept. 8, at Washington, D. C.

Compressed Air Cars in Chicago.

We have several times mentioned the good work of the compressed air cars in service on the North Clark street cable line in Chicago. These are Hardie motors and ran a year in New York before going to Chicago. There they were put in the "owl" service, running after the cable was stopped for the night, and have run there about 15 months. The Chicago City Railroad Company has now bought the cars and the compressing plant.

THE SCRAP HEAP.

Notes.

On the 13th a small bridge on the Cairo Division of the Big Four failed under a freight engine and caboose. One man was drowned and two others died of injuries and two others were seriously, possibly fatally, injured.

On the 15th a derailment occurred on the Lehigh Valley which has particular interest for railroad officers. A special train, consisting of engine, passenger coach and private car, was running backwards over the Bowman's Creek Branch, for observation, at about 12 miles an hour. It struck a small piece of timber which is supposed to have fallen from a car loaded with firewood, and the truck of the private car was derailed and the car rolled over a 12-ft. bank. The engine did not leave the track. In the car were the General Superintendent, Mr. Wilbur; Division Superintendent, Mr. Alexander Mitchell; Chief Engineer, Mr. Berg; Engineer Maintenance of Way, Mr. Ashby. No one was seriously injured, except Mr Mitchell, who had a scalp wound and severe bruises of the body, and Mr. Berg, who received a wound over the right eye and a very painful sprain of the right hand. Mr. Mitchell's condition is now reported to be very much improved.

London Underground Railroads.

The first week's traffic on the Central London Railway exceeded the expectations of the directors. Trains started running on Monday, July 30, with a five minute service, and carried 85,400 passengers. The following days the members were 91,900, 86,700, 96,100, 80,700, 64,742, 100,391 (Bank holiday), 105,171. As the whole of the trains are not yet in service there have been many complaints of overcrowding, and more trains are being got ready with the utmost expedition so that in a few days a four minute service will be given. As further trains are added a 3½ and 3 minute service will be gradually introduced. No season tickets are issued on this line, but books of 24 tickets are sold. The directors' report just issued gives the total capital outlay at £3,353,597. If experience shows that an alteration should be made in the present charge of 2d for any length journey, the board will make it. Fault is found because the minimum fare is double the amount of competing 'bus charges. The Metropolitan Underground is stated to be feeling the competition, and what has now been dubbed "the tuppenny tube" is quite popular.

The report of the Waterloo & City Electric Railway shows that during the first six months of 1900 1,868,737 passengers were carried, an increase of 150,000 over the same period of last year. There are 911 season ticket holders as compared with 747 last year. The gross receipts are £14,133, of which the London & South Western Railway retains £5,398 for working expenses, and pays £8,735 for guaranteed 3 per cent. dividend.

The Great Northern & City Electric Railway directors report progress in the construction of tunnels, and the speed of constructing will soon be greatly accelerated by the erection of four additional shields at Drayton Park, and Old Street E. C. At Regent's Canal the up and down line tunnels have been driven for a mile of single line altogether. The Essex Road Station tunnel for the down line has been driven to its full length, and that for the up line to about half its length.

Industries of Sault Ste. Marie.

There are on the Canadian side of Sault Ste. Marie the Algoma Commercial Company, the Canadian Steel Company, the Sault Ste. Marie Pulp & Paper Company, and the Lake Superior Power Company. American power companies are supplying power to numerous companies, and are also supplying the city of Sault Ste. Marie with both electric and water power. They have at the present time a capacity for developing 16,800 hp. by 42 turbine wheels of 400 hp. each. The intention is to build an additional one of much larger capacity. The pulp company is turning out 150 tons of pulp per day, practically all of which goes to France, Germany and England. The managers have a large sulphide plant under construction, which will be finished in a few weeks, and have an output of 75 tons of chemical pulp per day. They also have very large iron works and manufacture a great deal of their machinery, including many electric appliances; and they have made in their own works the iron columns for their new buildings. They have also under way smelting works for the manufacture of pig iron, and, with the addition of the nickel ore received from their own mines at Sudbury, will make "ferro-nickel pig." These companies also control on the American side of Sault Ste. Marie, Mich., the Lake Superior Power Company, the Union Carbide Company, American Alkali Company, and the Michigan Reduction Company. They are constructing a canal on the Michigan side and water-power works which will contain 360 turbine wheels with a capacity of 125 hp. each. The capitalization is $3,500,000, and the works will cost that when completed. The water power on the Michigan side will also be used to run factories similar to those now on the Canadian side, with a carbide mill and an alkali factory in addition. The product of the carbide mills is owned by the Carbide Company, of Chicago, and the product of the alkali factory by the American Alkali Company, of Philadelphia.

Specifications for a Master Mechanic.

Mr. J. Kruttschnitt, Fourth Vice-President and General Manager of the Southern Pacific, in a recent communication to the Pacific Coast Railway Club, gives his specifications for a master mechanic: "A successful master mechanic must be two-sided. He must not only keep the machinery under his charge in proper order, but he must discipline, direct and control the animated human machine that operates the inanimate tools or engines. He should, therefore, be a good mechanic as well as a good leader of men. He should be familiar with tools, and should understand theoretically and practically the locomotive and other steam engines as well as the laws of combustion. He can not ignore gas and petroleum motors. He should cultivate the habit of critically analyzing operating results shown in statements issued from his own and the accounting offices. He should be a student of current, technical literature. He should attend the meetings of technical societies, and under no circumstances should he fail to study their proceedings. He should cultivate a spirit of relentless self-criticism; should never be quite satisfied with what he has accomplished, and should determine to excel all others engaged in his particular line of work. To be a good leader of men, he should cultivate perfect patience, forbearance and self-control, remembering that no man ever controlled others who did not start by controlling himself. He should be even-tempered, or, if not born so, should not let any one discover it. He should be strictly just, granting cheerfully everything due his employees while jealously guarding his employer's interests, curbing his generosity in spending funds entrusted to him. A man so qualified should make a successful master mechanic, but would not long remain one in the present day of keen competition in all branches of railroad service."

Horse Power of Machinery at Paris Exposition.

Consul-General Guenther says: "The modern demand for high-power machinery is shown by a comparison of the machinery exhibited at the last four world's expositions at Paris. In 1867, there were exhibited and operated 52 machines, with an aggregate of 854 hp.; in 1878, 41 machines, aggregating 2,533 hp.; in 1889, 32 machines, with 5,320 hp.; and in 1900, 37 machines, with 36,085 hp. The average hp. per machine exhibited in 1867 was 16; in 1878, 62; in 1889, 170; and in 1900, 973. France this year exhibits and operates 18 machines, with an aggregate of 14,435 and an average of 802 hp. Other countries operate 19 machines, with 21,650, or an average of 1,140 hp.

Electrical Power at Kiel.

Consul-General Guenther writes: "Steam power is to be superseded by electricity to a very considerable extent in the government dockyard at Kiel, Germany. After experimenting with electric-power transmission on a comparatively small scale, the administration has now decided upon a bolder scheme, whereby all the machine tools, etc., installed in the different workshops are to be electrically driven. To this end, a power plant having a capacity of 3,500 hp. is to be erected. This plant will also supply electrical energy for driving the powerful dockyard pumps."

The New Paris Underground.

The Orleans Company continues to develop its service to the new station at the Quay d'Orsay. Since the first of August baggage has been carried to that station and a certain number of long distance trains have been run through to the new station. The suburban trains using this station do not, up to the present time, take baggage.

The Schoen Exhibit at Paris.

In the Paris *Figaro* of July 27 appears a long article on the lessons of the remarkable exhibit made by the Pressed Steel Car Company, at Paris. The writer appears to have grasped the notion new to many Europeans that it is of much greater importance to humanity to have freight carried cheap than to have fast trains or low passenger rates. To the fact that the United States has developed this art to such a great degree he attributes much of our growing commercial supremacy. He describes the development in theory and in practice of Mr. Schoen's designs and inventions, culminating in the magnificent exhibit at the World's Fair. This article is signed by Mr. Emile Gautier.

LOCOMOTIVE BUILDING.

The Tennessee Central is having one engine built by the Baldwin Locomotive Works.

The Norfolk & Southern is having one engine built by the Schenectady Locomotive Works.

The Louisville & Nashville is reported to be in the market for 10 consolidation locomotives.

The General Electric Co. has ordered one locomotive from the Schenectady Locomotive Works.

The Intercolonial of Canada has ordered eight heavy engines, for fast passenger service, from the Manchester Locomotive Works.

The Grand Trunk, it is stated, has placed orders for a number of mogul engines with the Dickson Locomotive Works and the Brooks Locomotive Works.

The State Railroad of Chile order with the Rogers Locomotive Co., referred to in our issue of Aug. 10, calls for six consolidation and two mogul engines. The former will have 16 in. x 18 in. cylinders, 39 in. driving wheels and will weigh 74,000 lbs., with 68,000 lbs. on the driving wheels; heating surface, tubes, 860.8 sq. ft., fire-box 74.14 sq. ft., total 935.22 sq. ft.; grate area, 12.6 sq. ft.; tubes, 146, brass, 2 in. in diam. and 11 ft. 3 in. long; boilers, wagon top type, 48 in. in diam.; working steam pressure, 200 lbs. The mogul engines will have 18 in. x 24 in. cylinders, 50 in. driving wheels and will weigh 112,000 lbs., with 96,000 lbs. on the driving wheels; heating surface, tubes, 1,311 sq. ft., fire-box, 140 sq. ft., total 1,451 sq. ft.; grate area, 26.25 sq. ft.; the boilers will be of the straight top radial stay type with 221 brass tubes 2 in. in diam. and 11 ft. 4 in. long, and will measure 60 in. in diam.

CAR BUILDING.

The Colorado Midland is in the market for 100 stock cars.

The Armour Packing Co. is in the market for 500 fruit cars.

The Philadelphia & Reading is having 200 cars built by the Middletown Car Works.

The General Chemical Co., of New York, is having 10 cars built by the Erie Car Works.

The St. Louis, Troy & Eastern has ordered 50 cars from the American Car & Foundry Co.

The Southwest Chemical Co. has bought six tank cars from the American Car & Foundry Co.

The Algoma Central has ordered 100 flat cars of 80,000 lbs. capacity from the Pullman Co. Bettendorf truck and body bolsters will be used.

The Atchison, Topeka & Santa Fe is asking bids on 500 refrigerator cars of 60,000 lbs. capacity. The road is also in the market for eight dining cars.

BRIDGE BUILDING.

ALLEGHENY, PA.—A wooden bridge connecting Cass avenue with the Verner Road was partially destroyed by fire Aug. 18. The bridge was built many years ago and the company was about ready to replace it with a modern structure.

ALLENTOWN, PA.—Application is to be made for a charter for the Allentown & South Allentown Bridge Co., which proposes to build a bridge from the foot of Eighth street, Allentown, at Union street, across the Meadows to a point near Fairview cemetery. It is to be a steel deck structure, about 1,900 ft. long and 46 ft. wide. The highest point will be about 105 ft. above the Meadows.

CORAOPOLIS, PA.—The Pittsburgh & Lake Erie has let the contract for a bridge to connect the main line with Neville Island from a point north of Coraopolis. It is to consist of four spans aggregating 750 ft., and the contract price is about $100,000.

CORSICANA, TEX.—The County of Navarro has obtained the ferry right across the Trinity River at Porter's Bluff, which clears the way for a new steel bridge across the river.

COURTLAND, ALA.—The Board of Revenue of Lawrence County will build a steel bridge over Big Nance Creek instead of repairing the old one as was at first decided.

FAIRMOUNT, W. VA.—The Hite Coal & Coke Co. is reported to have begun building a steel bridge across the Tygart's Valley River to its coal tract. The main span will be 520 ft. long and 80 ft. above the river bed. Total cost, $75,000.

FAIR OAKS, CAL.—Bids are wanted, Sept. 6, by the Board of Supervisors for a steel highway bridge over the American River, between Fair Oaks and Orangevale. It is to have two spans of 160 ft. each. Wm. B. Hamilton, Clerk to the Board. See also Sacramento, Cal.

KEMPTVILLE, ONT.—The masonry contract for a new swing bridge at this city has been given to Geo. Bradford, of Almonte, Ont., and the superstructure to the Hamilton Bridge Works. E. T. Wilkie, of Carleton Place, Ontario, is Engineer.

KILLARNEY, MAN.—Plans are reported being prepared in the Public Works Department for a truss bridge, with stone abutments, over the Little Pembina River at a point northwest of this place.

LOGAN, IOWA.—The Sioux City & Pacific is making preparations to build a $20,000 bridge over Little Sioux River in Harrison County.

MOUNT VERNON, N. Y.—The Common Council has asked bids up to Sept. 4 at 8 p. m. for $30,000 bridge bonds.

NATICK, R. I.—The long wooden bridge on which the central division of the New York, New Haven & Hartford crosses the Pawtuxet River between Natick and Pontiac, was destroyed by fire, Aug. 12. It was 300 ft. long and was built in 1853.

NEW YORK, N. Y.—Injunctions were served, Aug. 17, upon Acting Mayor Guggenheimer and on the East River Bridge Commission, in behalf of some of the bidders for the Manhattan and Brooklyn approaches to the new East River bridge, to restrain them from voting to award the contract. The courts are asked to set aside all bids and to order that new bids be re-advertised. (Aug. 17, p. 559.)

Rolf Bros., of Manhattan, have the contract for the Grand street bridge over Newtown Creek at $200,000.

PITTSBURGH, PA.—The Pittsburgh, Fort Wayne & Chicago has abandoned the idea of enlarging the bridge over the Allegheny River at Eleventh street and is considering plans for an entirely new structure, with one less pier in the middle of the river.

PORTAGE DU FORT, QUE.—The Secretary of the Public Works Department at Ottawa is asking tenders for the iron superstructure for the inter-provincial bridge over the Ottawa River at the "Narrows." A certified check for $3,000 is to accompany each tender.

SACRAMENTO, CAL.—Bids are wanted, Sept. 6, by the Board of Supervisors for a steel draw bridge over Georgiana Slough, at Walnut Grove. It will be 220 ft. long. J. C. Boyd, County Surveyor. See also Fair Oaks, Cal.

SOMERVILLE, N. J.—The Somerset County Board of Freeholders has announced estimates for bridges for the coming year amounting to $27,500 as follows: Bedminster, $2,800; Bernards, $1,700; Branchburg, $1,800; Bridgewater, $5,000; Franklin, $5,500; Hillsborough, $3,800; Montgomery, $1,800; North Plainfield, $2,700; Warren, $2,400.

TROY, N. Y.—Application was made to the State Railroad Commission, Aug. 15, by the Stillwater & Mechanicsville Street R. R. Co. for permission to build a bridge over the Hudson River near Waterford, to connect with the tracks of the Union Traction Co. at the car barns in Lansingburg.

WATERTOWN, N. Y.—The State Board of Railroad Commissioners gave a hearing, Aug. 17, in this town on the application for an overhead crossing at Arsenal street, over the N. Y. C. & H. R. R. R.

WINNIPEG, MAN.—The Canadian Pacific is calling for tenders for building abutments for a 60-ft. bridge across Cook's Creek, East Selkirk; for a 25-ft. arch culvert at Strawberry Creek, Kaministiquia; two abutments for a 60-ft. span bridge at Fish Creek, three miles west of Maple Creek; pier and abutments for two 60-ft. span bridges over Pipestone Creek, Laggan, and for a 25-ft. arch culvert near Murray Park, on the Southwestern branch.

Other Structures.

EAST ANDOVER, N. H.—The freight house is being moved to prepare for a new passenger station.

MOLINE, ILL.—Plans have been completed for the new freight depot on Third avenue east of Twenty-first street for the Davenport, Rock Island & Northwestern, which is building an extension to that city. Bids will be asked soon.

PASSAIC, N. J.—The contract has been awarded for the Delaware, Lackawanna & Western depot on Van Houten avenue, near Passaic avenue. (Aug. 10, p. 544.)

PITTSBURGH, PA.—The contract for the steel work on the new Allegheny observatory of the Western University has been let to the Carnegie Co.

ST. JOSEPH, MO.—At a meeting of the representatives of railroads in South St. Joseph, Aug. 14, it was decided to build a large stone depot in South St. Joseph, near the packing houses.

SEATTLE, WASH.—Local press reports say that work on the new station of the Great Northern will be begun within two weeks, and that it will be completed by July 1, 1901.

WEST ORANGE, N. J.—Work is to be begun on a new station for the Erie R. R. at this point. Other improvements proposed are a new freight yard and freight house.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xi.)

The American Street Railway Association.

The annual meeting will be held at Convention Hall, Kansas City, Mo., Oct. 16 to 19. The following papers will be read: "Double Truck Cars, How to Equip Them to Obtain Maximum Efficiency Under Varying Conditions," "Construction, Operation and Maintenance of Roads That Operate 20 Cars or Less," "Comparisons of the Various Systems of Electrical Distribution for Street Railroads," "Consolidation of Street Railroads and Its Effect Upon the Public," "The Store Room and Store Room Accounting," "Painting, Repainting and Maintenance of Car Bodies." T. C. Pennington, Secretary, 2020 State street, Chicago, Ill.

Municipal Electricians.

The International Association of Municipal Electricians will hold their fifth annual convention in Pittsburgh, Sept. 25, 26 and 27. The President of this Association is Mr. William Brophy, of Boston, Mass., Chief Electrician, Wire Department. The Secretary is Mr. G. H. F. Cottell, also of Boston, City Electrician. The Chairman of the Executive Committee is Mr. M. W. Mead, Superintendent Bureau of Electricity, Pittsburgh, Pa. From either of these gentlemen any information with regard to the meeting can doubtless be had. There are five stated papers to be presented on matters especially interesting to those who have to do with electrical wires and apparatus in cities. Various interesting excursions have been planned by the local committee and arrangements will be made for members to inspect the works of the Westinghouse Electric & Mfg. Co., the Westinghouse Air-Brake Co., and the Standard Underground Cable Company, of Pittsburgh. The headquarters of the meeting will be at the Monongahela House, where the sessions will be held.

Superintendents of Bridges and Buildings.

The tenth annual convention of the Association of Railway Superintendents of Bridges and Buildings will be held at the Southern Hotel, St. Louis, Oct. 16 to 18 inclusive. The programme of reports and papers to be presented and the subjects to be discussed is very long, and we observe that provision is made for a morning and evening session each day except Thursday, when the afternoon will be devoted to sight-seeing. Obviously, this society means business. We shall not attempt to print the names of all of the reports and topics, but they cover tools for bridge gangs, snow fences, concrete, hand or power riveting, tie plates on bridges, painting bridges, the kind of timber for bridges, highway crossings, pumps for water stations, fire prevention and repairs without false work. Mr. Berg, Chief Engineer of the Lehigh Valley, will present a paper on the "Education of Railroad Men" and Mr. Onward Bates, Engineer and Superintendent of Bridges and Buildings of the Chicago, Milwaukee & St. Paul, will present a paper on "The Superintendent of Bridges and Buildings." The Secretary of this Association is Mr. S. F. Patterson, Boston & Maine R. R., Concord, N. H., from whom further information can, of course, be obtained.

Iron and Steel Institute.

In accordance with previous announcements, the Autumn Meeting of the Iron and Steel Institute (British) will be held at Paris, Sept. 18 to 21.

The President, Sir William Roberts-Austen, will deliver an address, and the following papers have been promised: On the development of the iron and steel industries in France since 1889, by H. Pinget, Secretary of the Comité des Forges de France; On iron and steel at the Paris Exhibition, by Prof. H. Bauerman (Ordnance College, Woolwich); On American methods of testing iron and steel, by Albert Ladd Colby (South Bethlehem, Pennsylvania); On the washing of iron ore, by Alfonso Dory (Bilbao); On rolling-mills, by Louis Katona (Resicza, Hungary); On the constitution of slags, by Baron H. von Jüptner (Donawitz, Austria); On a new method of producing high temperatures, by E. F. S. Lange (Manchester); On the action of aluminum on the carbon of cast iron, by Godfrey Melland, B. Sc., Assoc. R. S. M., and H. W. Waldron, Mason University College, Birmingham; On a microchemical research on iron and phosphorus, by J. E. Stead, Member of Council. The Provisional Programme follows:

Sept. 17.—The Secretaries' office will be open at 44 Rue de Rennes, for the issue of badges, etc. At 6 p. m. there will be a meeting of council.

Sept. 18.—Reception of the President, council and members of the Institute in the hall of the Société d'Encouragement by the President and Members of the Reception Committee; reading and discussion of papers; visit to the Exhibition under the guidance of experts; members and ladies are invited by the Comité des Forges de France to a soirée musicale et littéraire.

Sept. 19.—General meeting; visit to the Exhibition; the Institute will entertain the Reception Committee at a banquet at the Hôtel Continental, Rue Castiglione.

Sept. 20.—Visit to the Exhibition at Vincennes (Locomotives, Railway Plant, and Machine Tools); in the evening members will leave Paris by train to visit works, viz.: the St. Chamond Works, and the Hayange Works.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. F. C. Batchelder, Superintendent of the Chicago Division of the Baltimore & Ohio, has been in railroad service since April, 1874. He was employed with the Chicago, Milwaukee & St. Paul as operator, agent, Train Dispatcher and Chief Train Dispatcher until March, 1888. He was then employed with the Milwaukee, St. Paul & Sault Ste. Marie as Chief Train Dispatcher until July, 1893; as Assistant Superintendent until April, 1898, and as Division Superintendent to June 30, 1899. He entered the service of the Baltimore & Ohio as Division Superintendent on July 1, 1899.

—Mr. William Hunter, Acting Chief Engineer of the Philadelphia & Reading, has been appointed Chief Engineer. Mr. Hunter was born at Moselem, Berks Co., Pa., May 25, 1854. He was graduated from the Polytechnic College of the State of Pennsylvania in 1872 and entered railroad service in July, of the same year, with the Philadelphia & Reading as back-rod of the location corps. He has served successively in the engineering department as chainman, topographer, levelman and transitman, until January, 1876. During that year he was in charge of Hematite ore mining. The two years following were passed as levelman and Division Engineer on location and building of the Pittsburgh & Lake Erie. He returned to the Philadelphia & Reading in the fall of 1878 and has since continued with that company, serving as Assistant Engineer, division roadmaster, assistant roadmaster, Assistant Chief Engineer and Acting Chief Engineer.

—Mr. Frederic A. Miller, who is to succeed Mr. G. F. Heafford as General Passenger Agent of the Chicago, Milwaukee & St. Paul, at Chicago, has been connected with the passenger department of that company since the early part of 1883. Mr. Miller was born at Harford, Pa., in 1856. He began his railroad service in 1874 with the Cairo & Vincennes, now part of the Cleveland, Cincinnati, Chicago & St. Louis, at Cairo, Ill., as cashier and ticket seller. He served successively with that company as freight and ticket agent, as clerk in the General Freight and Passenger Office, and in 1878 as General Passenger Agent. When the road was sold to the Wabash, in 1882, he was transferred to the parent company and appointed Union ticket agent at Cairo. In 1883 he entered the General Passenger Department of his present company, the Chicago, Milwaukee & St. Paul, as a clerk. Two years later he was appointed General Agent, and in 1887 Assistant General Passenger Agent, the office he still holds.

—Mr. Benjamin Norton, President and General Manager of the Toledo, St. Louis & Western, the successor company to the Toledo, St. Louis & Kansas City, was born at Erie, Pa., December 18, 1855. His earliest work in the railroad field was as Counsel for the New York & Canada, now a part of the Delaware & Hudson. Later he served as a clerk in the Freight Department of the Indianapolis, Bloomington & Western road at Indianapolis, Ind. On. Jan. 1, 1881, he went with the Long Island as Purchasing Agent. He was subsequently Assistant Superintendent and Traffic Manager until April, 1888, when he was elected Second Vice-President and General Manager of the company. After holding that position for five years, he accepted the presidency of the Atlantic Avenue Ry. Co., of Brooklyn, whose lines were being transformed from horse to electric power under the Philadelphia syndicate. On March 4, 1899, he took charge of the Ohio Southern as General Manager for the purchasers, who took possession of the property on that date. Under his control the Ohio Southern was entirely rebuilt and put in first-class condition. He was elected President and General Manager of his present company, the Toledo, St. Louis & Western, on Aug. 1.

—At the last "Commencement" the University of Michigan conferred upon Mr. A. A. Robinson, President of the Mexican Central, the degree of Doctor of Laws. Mr. Robinson was graduated from the University of Michigan in 1869 with the degrees of C. E. and B. S., and in 1871 he received the degree of Master of Science. He began his railroad work in the civil engineering department of the St. Joseph & Denver City Railroad, and in April, 1871, became Assistant Engineer on the Atchison, Topeka & Santa Fe in charge of location and construction. Two years later he was made Chief Engineer, which position he held until August, 1890. During this time he also served as General Superintendent, as General Manager and as Second Vice-President and General Manager for different periods. The latter office he held from May, 1888, to April, 1893, when he accepted the presidency of the Mexican Central. He has had direct charge of the construction of over 4,500 miles of railroad, and built the Pueblo & Denver line of the Atchison, 116 miles long, in seven months, and the extension from Kansas City to Chicago, 458 miles, between April and December of the same year. Mr. Robinson was born in South Reading, Vt., Oct. 21, 1844, and is descended directly from Jonathan Robinson, who was born in Cambridge, Mass., in 1682, whose father, William Robinson, was one of the early settlers of Cambridge. Another ancestor, Ebenezer Robinson, served two years in the Revolutionary War. Thus we see that Mr. Robinson comes of a breed from which we may expect all that is best in building our nation.

ELECTIONS AND APPOINTMENTS.

Boston & Maine.—J. S. Turner has been appointed Master Mechanic of the Fitchburg Division, with headquarters at Charlestown, Mass. E. Elden, heretofore Division Master Mechanic at Boston, Mass., has been transferred as Assistant Master Mechanic of the Fitchburg Division, with headquarters at Mechanicville, N. Y. W. Harrington has been transferred as Engine House Foreman at Worcester, Mass.; F. I. Goodwin becomes Engine House Foreman at Charlestown, Mass., and J. H. Maysilles becomes Foreman at Mechanicville, N. Y. H. W. Carson has been appointed Acting Engine House Foreman at East Deerfield, Mass.

Colorado Midland.—J. R. Groves has been appointed Superintendent of Machinery, succeeding A. L. Humphrey, resigned to accept service with another company, effective Aug. 13.

Colorado & Southern.—J. O. Matthews has been appointed Superintendent, with headquarters at Cheyenne, Wyo., succeeding J. A. Rasbach, transferred.

Copper Range.—The announcement recently made (p. 545) that W. A. Paine had resigned as President of this company was an error.

Delaware, Lackawanna & Western.—T. E. Clarke has been appointed Superintendent of the Scranton Division, with headquarters at Scranton, Pa., succeeding A. C. Salisbury, resigned.

Gulf & Brazos Valley.—W. C. Forbes has been appointed General Superintendent.

Kansas, Missouri & Northern.—The officers of this company referred to in the Construction column are: President, R. A. Reese, Dallas, Tex.; Vice-President, Malo Stewart, Galveston, Tex.; Secretary, Jules Bertero, St. Louis; Treasurer, Alex Konta, Empire Building, New York City; Engineer, R. S. Doubleday, St. Louis.

Kentucky & Indiana Bridge & R. R.—The officers of this company, recently re-organized, are: President, F. S. Gannon; Vice-President, W. H. McDoel; Secretary and Treasurer, H. W. Heazlitt; and General Manager, B. S. Josselyn. The directors are: W. M. Greene, W. H. McDoel, F. S. Gannon, Judson Harmon, E. F. Trabue and A. P. Humphrey. (See R. R. News column.)

Lake Erie & Western.—H. B. Minnick has been appointed Foreman of Locomotive Repairs, with headquarters at Lima, Ohio, succeeding C. Reilly, resigned.

Lake Michigan & Lake Superior Transportation Co.—W. L. Guthrie is General Freight Agent at Chicago, Ill., having succeeded Frank Ferris.

Louisville & Nashville.—O. B. Hollingsworth has been appointed Superintendent of the Cumberland Valley Division, succeeding J. W. Logsdon, who has been transferred as Division Superintendent at Evansville, Ind.

Mexican Central.—Hans Bentele has been appointed Assistant Chief Engineer, with headquarters at Mexico, Mex.

Rutland.—On Aug. 10, C. B. Hibbard, in addition to his duties as General Passenger Agent, assumed, temporarily, the duties of General Superintendent, succeeding the late C. L. Pierce.

Southern Pacific.—The New Mexico & Arizona R. R. has become a part of the Arizona Division of the S. P., under the Superintendency of E. Randolph, with headquarters at Tucson, Ariz.

Toledo, St. Louis & Western.—Alexander M. Tremp has been appointed Master Mechanic, with headquarters at Frankfort, Ind., effective Aug. 15.

Union.—E. C. Brown, late Principal Assistant Engineer of the Pittsburgh, Bessemer & Lake Erie, has been appointed Engineer Maintenance of Way, effective Aug. 1.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ALBANY & HUDSON.—The new electric line between Albany, N. Y., and Hudson, about 38 miles, is completed. It is operated by the third rail. The company is successor to the Kinderhook & Hudson, and 18 miles of the line from Niverville is new. A. M. Young, of New York city, is President, and Maurice Hoopes, General Manager. (April 13, p. 245.)

ALBANY & SCHENECTADY TRACTION.—This company was incorporated in New York, Aug. 17, with a capital stock of $100,000, to build an electric line from Albany west nine miles to the Schenectady County line. Chas. Pfitzer, Jr., of New York City, Jesse H. Leonard and T. E. Kerwin, of Albany, are directors.

ALGOMA CENTRAL.—An officer confirms the statement that the company has obtained a franchise of the old Hudson Bay & Sault Ste. Marie and will build that line. (Aug. 10, p. 545.)

ANN ARBOR.—The work on the roadbed between Copemish, Mich., and Mt. Pleasant is confined for the remainder of the season to providing new ballast. (Aug. 10, p. 545.) The grades in this district are now corrected to standard. (Official.)

ARKANSAS & MISSOURI.—This company has been incorporated, with a capital stock of $4,000,000, to build a line from Little Rock north 212 miles to Springfield, Mo. The incorporators are men connected with the Arkansas Northern, whose charter was recently declared forfeited. W. B. Worthen, of Little Rock, is President; James E. Fones, Vice-President; Oscar T. Davis, Secretary, and T. L. Cox, Treasurer. (A. N., Aug. 17, p. 559.)

ATCHISON, TOPEKA & SANTA FE.—The company expects to reduce the grades between Olathe, Kan., and Ottawa, from 42 ft. per mile to 21 ft. Surveys are also being made in New Mexico with a view to reducing the grades between Raton and Las Vegas. (Official.)

BALTIMORE & OHIO.—Surveys are reported in progress for a cut-off in Washington County, Pa., from Zediker's Station to a point near Wyland.

BATON ROUGE, HAMMOND & EASTERN.—Surveys are reported completed and building to be begun in about 60 days on this line from Baton Rouge, La., east about 45 miles to Hammond, and thence to Carriere, Miss., in all about 93 miles. W. R. Watson is President, and S. L. Ballard, of Hammond, is Chief Engineer. (Construction Supplement, July 27, 1900.)

CENTRAL OF GEORGIA.—An officer writes that surveys are in progress but not yet completed for the line from Arlington, Ga., northeast about 30 miles to Dawson. The Board of Directors is yet to decide whether the road will be built. (Aug. 3, p. 531.)

CHICAGO & NORTHWESTERN.—An officer writes that he knows nothing of the projected line from Interior, Mich., to Mass City. (Aug. 10, p. 546.)

CITY TERMINAL.—This company has been formed to build terminal lines at Kansas City, Mo., and Kan. It is understood that the Chicago Great Western is interested. Frank Hagerman, of Kansas City, is President.

COLUMBUS & NORTHERN.—A mortgage for $500,000 has been filed in Grant County, N. Mex., to cover 5 per cent. 45-year gold bonds on this line, which is projected from Columbus, Grant County, to run north 35 miles to Deming. Andrew O. Bailey, of Columbus, N. Mex., is President. The Central Trust Co., New York, is trustee. (Construction Supplement, July 27, 1900.)

COLUMBIA & PUGET SOUND.—The city of Seattle, Wash., has passed an ordinance amending the right of way of this company and the Oregon & Transcontinental R. R. Co., for a single or double track line along the water front of the city.

CRANDON.—This company has been incorporated in Wisconsin, with a capital stock of $55,000, to build a railroad from Crandon, Forest County, 16 miles long. The incorporators are: H. F. Landeck, of Milwaukee; M. D. Keith, Nellie E. Keith, J. T. Houle and F. C. Week, of New London.

DAYTON, NEW CARLISLE & ST. PARIS TRACTION.—A mortgage for $1,350,000 has been filed by this company with the Central Realty Bond & Trust Co., New York, as trustee, on its proposed electric line from Dayton, Ohio, via New Carlisle to St. Paris, 34 miles. The line is to be completed early next year. E. H. Rannels, of New Carlisle, is President.

DELAWARE & HUDSON.—Contracts are reported let for reducing grade on 7½ miles of track on the Susquehanna Division below Ninevah, N. Y. The reduction is to be made from 32 ft. per mile to 15 ft. It is stated that the work is to be completed by Nov. 1.

EAST ST. LOUIS, MADISON & GRANITE CITY.—This company has been incorporated in Illinois, with a capital stock of $50,000, to build a railroad from Granite City, Madison County, to East St. Louis. The principal office is East St. Louis. Among the incorporators are Thomas W. Scott, Fairfield, Ill.; Edward C. Kramer and Thomas L. Fekete, East St. Louis, Ill.; Alexander, P. Humphrey, Louisville, Ky.; George T. Jarvis, Indianapolis, Ind., and Frederick Kohl, of Venice.

GULF & INTERSTATE.—An officer writes that the improvements contemplated on this line consist of a general renewal of ties, raising of track and ballasting about 10 miles; also extensive yard improvements at Beaumont, Tex. (Aug. 3, p. 531.)

KANSAS CITY, OKLAHOMA & SOUTHERN RAILROAD & CONSTRUCTION.—This company has been incorporated in Oklahoma Territory, with a capital stock of $500,000, to build a railroad from Medford Junction, on the Atchison, Topeka & Santa Fe and the Chicago, Rock Island & Pacific, to run southwest about 50 miles to Augusta. Adolphus Owings, Garfield County, and Helena M. Patterson and Geo. J. Patterson, of Grant County, are directors.

KANSAS, MISSOURI & NORTHERN.—Grading is completed from Savanna, Mo., to Fillmore, 13 miles, and from Kansas City, Mo., to St. Joseph, 50 miles, on this line from Kansas City, Mo., north up the Missouri River, 150 miles via St. Joseph, Savanna and Tarkio to Omaha, Neb., with a branch from Maitland, Mo., to Maryville, 25 miles. Progress has been delayed pending negotiations for the consolidation with another company. (Construction Supplement, July 27, 1900.) The officers are given under Elections and Appointments. (Official.)

LAKE ERIE & DETROIT RIVER.—Bids are asked by the Chief Engineer for grading 25 miles of extension from Ridgetown, Ont., to Dutton. Grading must be begun by Sept. 1 and completed by Nov. 8, following. This is part of the proposed extension to St. Thomas, 65 miles. (Construction Supplement, July 27, 1900.)

LONG ISLAND.—The New York State Railroad Commission on Aug. 15, granted an application of the Municipal Assembly and interested property owners for the abolition of the grade crossing at Avenue S and Eighteenth street, Brooklyn. The plans approved involve an elevation of the tracks 4½ ft., and depression of the highway 8 ft. The cost will be borne equally by the city and railroad.

LOUISVILLE & NASHVILLE.—The company will build a two-mile spur to the mines of the Anniston Brown Ore Co., Alexandria, Ala.

LYNCHBURGH & WARTRACE.—Chas. S. Northrop has taken a contract to build this line from Wartrace, Tenn., on the Nashville, Chattanooga & St. Louis, to run south 18½ miles to Lynchburg. John Y. Garlington, of Lynchburg, is General Manager, and L. B. Fuller, Chief Engineer. (July 13, p. 488.)

NORTHERN PACIFIC.—According to a reported statement of President Mellen, surveys have been made for a cut-off from Ellenburg, Wash., east about 100 miles to Lind. The line now runs via Pasco, 190 miles, which would effect a saving of about 90 miles. The surveys have been merely to gather data for future use.

OHIO VALLEY ELECTRIC.—This company has been incorporated in Ohio, West Virginia and Kentucky, with a capital of $1,000,000, to build an electric line from Huntington, W. Va., west across the Big Sandy River to Catlettsburg, Ky., thence northwest to Ashland, Ky., and thence across the Ohio River to Ironton, Ohio. The principal business place is at Huntington, W. Va. The incorporators are: Thomas J. Bryan (President), Henry S. Cato, C. W. Watts, H. C. Duncan, Jr., and L. T. Vinson (Secretary), all of Huntington, W. Va.

OREGON RAILROAD & NAVIGATION.—An officer denies the statement that a cut-off is to be built between Pendleton, Ore., and Umatilla. (Aug. 10, p. 546.)

PENNSYLVANIA.—Bids are invited, until Aug. 27, for double tracking 3½ miles of the South Fork branch from South Fork to Lovett, Pa.

Drake & Stratton have been awarded the contract for additional tracks and other improvements on the Pittsburgh, Virginia & Charleston between Birmingham Junction, Pa., and Hays.

PITTSBURGH, SHAWMUT & NORTHERN.—The New York State Railroad Commission, on Aug. 15, granted the application of this company for a change of gage from 3 ft. to standard between Olean and Bolivar, 18 miles, and also between Bolivar and Angelica.

PITTSBURGH & WESTERN TERMINAL.—This company has been incorporated by the Pittsburgh & Western to build terminals near Pittsburgh, Pa., including a line to connect Neville Island. J. L. Kirk, of Glenshaw, is President.

SAGINAW SOUTHERN.—The National Construction Co., of Detroit, Mich., has taken the contract for building this electric line from Bay City, Mich., south about 40 miles to Flint. It is to be equipped with the third-rail system. Isaac Bearinger is President, and W. P. Chappell, Secretary, both of Saginaw. (Construction Supplement, July 27, 1900.)

SEABOARD AIR LINE.—Preliminary surveys are reported made for a line from Greenville, S. C., to run southwest about 85 miles via Anderson, S. C., and Hartwell, Ga., to Athens.

SYRACUSE & ONEIDA LAKE, ELECTRIC.—The stockholders, on Aug. 21, were to vote to increase the capital stock from $300,000 to $1,200,000. The line is completed from Syracuse, N. Y., north 16 miles via Belgium and Three Rivers to Phoenix. W. B. Kirk is President.

TERRE HAUTE & WABASH VALLEY.—This company was incorporated in Indiana, Aug. 14, with a capital stock of $300,000, to build a railroad from Terre Haute south to the towns of Merom and Sullivan in Sullivan County, and north to the towns of Clinton and Rockville in Vermillion and Parke counties. Among the incorporators are: James R. Kendall, G. A. Conzman and B. G. Hudnut, of Terre Haute, Ind.

UNION PACIFIC.—An officer writes that there is no truth in the report that the company will build a new line between Evanston, Wyo., and Salt Lake City, Utah. (Aug. 10, p. 546.)

WAYCROSS AIR LINE.—New contracts are reported let and work begun at Fitzgerald, Ga., for the proposed extension from Ashley to Fitzgerald, 23 miles. (Construction Supplement, July 27, 1900.)

WEST VIRGINIA ROADS.—The Wilson Lumber Co., of Wilson, is reported building a narrow gage line about 10 miles long to reach timber lands in the vicinity of Fairfax.

WISCONSIN ROADS.—Holmes & Son are reported building a logging road from Pembine west nine miles.

GENERAL RAILROAD NEWS.

BOSTON & MAINE.—The gross earnings for the year ended June 30, 1900, were $22,148,602, against $19,890,607 for the preceding year, a gain of $2,257,995. The net earnings for this year were $6,583,641, against $6,184,630, a gain of $399,011. The dividends paid this year amounted to 6 per cent. on the preferred, and 7 per cent. on the common, a gain of 1 per cent. on the common over preceding years.

BROOKLYN RAPID TRANSIT.—The gross earnings for the year ended June 30, 1900, were $11,768,550, against $11,316,033 last year, a gain of $452,517. After deducting operating expenses, taxes, fixed charges, etc., the surplus was $526,772 this year. Last year there was a deficit of $201,881.

BROOKLYN UNION ELEVATED.—The company, on Aug. 15, bought at public auction all the unmortgaged assets of the old Brooklyn Elevated at $174,837. This was more than covered by the deficiency judgment held by the new company against the old corporation. (Feb. 9, 1899, p. 95.)

CENTRAL OF NEW JERSEY.—According to current reports, this property is to become part of the Baltimore & Ohio. *The Chronicle*, however, understands that negotiations long pending have not yet been concluded, and that if finally successful, they will involve not a lease of the Central but control through the ownership of stock.

CHICAGO & WESTERN INDIANA.—First mortgage bonds of 1879 to the par value of $104,000 have been drawn for the sinking fund to be redeemed Nov. 1 at the office of J. P. Morgan & Co., New York, at 105. (March 2, p. 146.)

CINCINNATI CONNECTING BELT.—First mortgage 5 per cent. bonds to the par value of $200,000 have been listed on the Philadelphia Stock Exchange. This is a new line controlled by the Cincinnati, Portsmouth & Virginia, and is in operation between Idlewild, near Cincinnati, Ohio, to Bond Hill Crossing over the Baltimore & Ohio Southwestern, 2.24 miles. This line is to be completed to Ivorydale, 1.75 miles additional, by Sept. 1. The capital stock is $300,000. (Construction Supplement, July 27, 1900.)

COLUMBIA SOUTHERN.—Drake C. O'Reilly, owner of $114,700 of the $300,000 capital stock of the company, has filed a suit in the State Circuit Court, at Moro, Ore., asking for a receiver on the ground of mismanagement of the property by the directors. The line runs from Biggs, Ore., south 70 miles to Shaniko. (Construction Supplement, July 27, 1900.)

FITCHBURG.—The stockholders will vote, on Sept. 14, on the ratification of the lease of the property to the Boston & Maine. (July 6, p. 472.)

KENTUCKY & INDIANA BRIDGE & RAILROAD.—The stockholders of this company, successor to the Kentucky & Indiana Bridge, have authorized a 4 per cent. mortgage for $2,500,000. It is reported that of this amount $1,000,000 will be reserved to satisfy the existing mortgage; $500,000 will be held for improvements and extensions, and the remaining $1,000,000 will be used to cover the purchase price. The company has been organized by officers representing the new owners which are the Southern, the Baltimore & Ohio and the Chicago, Indianapolis & Louisville. (Aug. 17, p. 560.)

KOOTENAY RAILWAY & NAVIGATION.—The Great Northern has bought a majority of the capital stock of this company which was recently completed from Bonner's Ferry, Idaho, on the Great Northern, north to Sandon, B. C. It is stated that the Great Northern guarantees the principal and interest on the existing debenture bonds. (June 30, 1899, p. 484.)

LOUISVILLE, EVANSVILLE & ST. LOUIS.—Judge Woods, of the U. S. Circuit Court, and Judge Allen, of the District Court in Illinois, have granted stays of proceedings to sell the property and an appeal will be taken to the U. S. Circuit Court of Appeals and afterward to the U. S. Supreme Court. It is stated that this action will prevent the sale of the property for two or three years. (Aug. 10, p. 546.)

MANHATTAN (ELEVATED).—The gross earnings for the year ended June 30, 1900, were $9,138,573, against $8,719,459, a gain of $419,114. The net earnings for this year were $3,905,953, against $3,458,329 last year, a gain of $447,624. The balance applicable to dividends this year was $2,029,513, on which 4 per cent. dividends have been declared amounting to $1,920,000.

MISSOURI, KANSAS & TEXAS.—The gross earnings for the year ended June 30, 1900, were $12,626,511, against $11,930,334 last year, a gain of $696,177. The net earnings this year were $3,861,042, against $3,917,506, a loss of $56,464. The balance surplus for the year amounts to $407,657.

MOBILE & OHIO.—An arrangement is reported made between this company and the Illinois Central for the joint use of their parallel tracks between East Cairo, Ill., and Fort Jefferson, Ky., about 5 miles. The M. & O. is to be used for south-bound and the I. C. for north-bound business.

MONTREAL & PROVIDENCE LINE.—A special meeting of the shareholders will be held at Montreal Sept. 12 at 4 p. m., to determine whether the directors shall be authorized to issue $200,000 additional bonds.

NEWFOUNDLAND.—The opposition of the Newfoundland Government to R. G. Reid's plan of turning over his railroad and allied properties in the Island to one joint stock company is forcing him to float the various portions of his enterprise as separate companies. The Reid-Newfoundland Steamship Co., with a capital stock of $2,500,000, has been announced and other companies covering the mining, forest, land and railroad interests will follow.

PENNSYLVANIA COMPANY.—Holders of guaranteed 3 per cent. trust certificates, series A, of Sept. 1, 1897, are notified that $50,000 is available from the sinking fund for the purchase of these bonds at not to exceed par and accrued interest. Proposals will be received up to Aug. 31 at 3 p. m. (June 8, p. 380.)

PITTSBURGH, BINGHAMTON & EASTERN.—The reported consolidation of this company with the Bradford Central and the Canton & Wellsburg is declared, by F. A. Sawyer, President of the P., B. & E., as altogether premature. (Aug. 10, p. 546.)

RIO GRANDE WESTERN.—A cash dividend of 5 per cent. is announced on the common stock. There were two dividends paid prior to this of 2 per cent. in 1898, and 1 per cent. in 1899, both in preferred shares of the company. (June 8, p. 380.)

SOUTHERN PACIFIC.—The gross earnings for the year ended June 30, 1900, were $63,268,404, an increase of $7,295,511 over last year, the largest gross earnings in the history of the company. The net earnings were $22,345,134, an increase of $2,397,251 over last year.

TACOMA EASTERN.—A mortgage has been made by the company to the Title Guarantee & Trust Co., of Portland, Ore., as trustee, to secure 6 per cent. bonds issuable at $20,000 per mile. The loan will provide for the extension of the line southeast about 39 miles, and for an indebtedness of $50,000 already incurred. Building is in progress on 10 miles of the line from Tacoma. (Jan. 19, p. 48.)

TEXAS, SABINE VALLEY & NORTHWESTERN.—Nearly all the bonds have been deposited with the Atlantic Trust Co. under the call of the Protective Committee.

UNION DEPOT & RAILROAD COMPANY OF DENVER.—The bonds of 1880, due, under the extension agreement, on Sept. 1 next, will be paid on that date at the office of the Union Pacific, New York.

WESTERN NEW YORK & PENNSYLVANIA.—The stockholders, on Sept. 13, will vote on leasing the property to the Pennsylvania. (July 20, p. 502.)

WISCASSET & QUEBEC.—The bondholders will meet at Wiscasset, Me., Aug. 27, to take over the control of this property. The road was built originally from Wiscasset to Albion, 42 miles, and has been extended about 11 miles further north from Albion, but this section has never been operated. (Nov. 10, 1899, p. 788.)